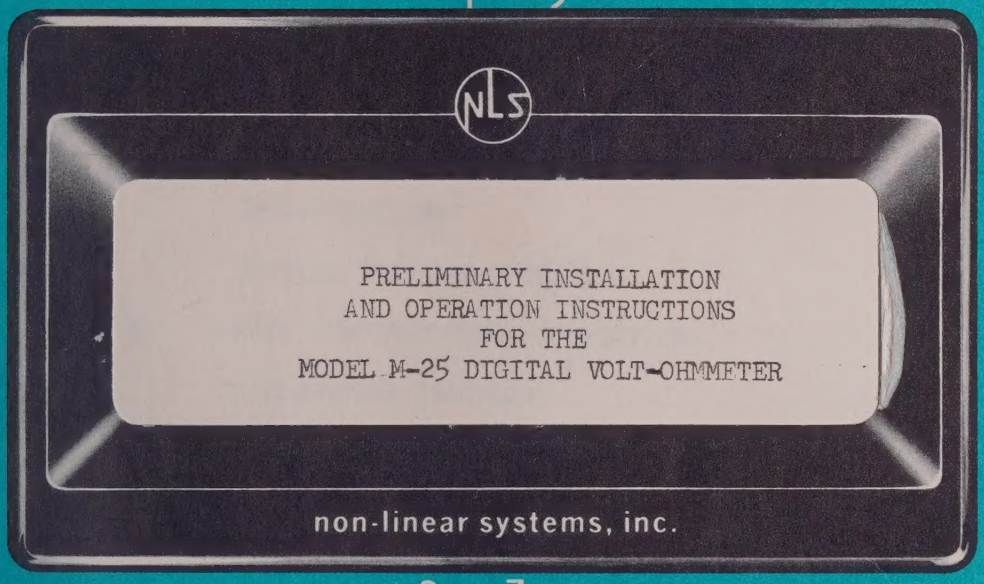

non | linear systems, inc.

DEL MAR, CALIFORNIA

DOCUMENT NO. 423
February 1962

PRELIMINARY INSTALLATION AND OPERATION INSTRUCTIONS FOR THE MODEL M-25 DIGITAL VOLT-OHMMETER

NON-LINEAR SYSTEMS, INC.

Del Mar, California

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LIST OF SCHEMATIC DIAGRAMS

10070 Sheet 4	CABLING DIAGRAM
	"A" UNIT
10070-009	MAIN BOARD
10070-011	DECADE
10070-013	6 STAGE COUNTER
10070-015	RANGE-FUNCTION
10070-017	POLARITY-DECISION
	"B" UNIT
10070-109	MAIN BOARD
10070-111	POWER SUPPLY
10070-113	REFERENCE-SUPPLY
10070-115	BUFFER
10070-117	AMPLIFIER-RANGE
10070-119	RECTIFIER
	CABLES
15004-075	INPUT CABLE
15004-077	EXTERNAL REFERENCE
15004-078	REFERENCE
15004-079	POWER & LOGIC

Document No. 423

PRELIMINARY INSTALLATION AND OPERATION INSTRUCTIONS FOR THE MODEL M-25 DIGITAL VOLT-OHMMETER

SECTION I - INTRODUCTION

The Model M-25 Volt-Ratio-Ohmmeter is a five digit instrument designed specifically for systems checkout. The high accuracy, speed, and reliability of the instrument are obtained by the use of semiconductors and mercury-wetted relays. The digital measurement, including decimal, sign and function is displayed on a removable, edge lighted readout developed by Non-Linear Systems, Inc.

The logic circuits of the instrument, which are made up of germanium transistors and silicon diodes, are duplicated many times in the instrument. Because of this, it has been possible to use identical plug-in units, thereby simplifying the stocking of spare parts. Furthermore the plug-in units have been made so that the computing and readout storage of each decade is contained in one unit. This is a useful feature in diagnosing malfunction in the computing processes of each decade.

Many desirable features of other NLS digital instruments are retained in the Model M-25. These include high input impedance, automatic range and polarity selection, and the ability to operate card punches, electric typewriters, and other printing devices. The Model M-25 is also equipped for use with an NLS Model 125E AC-DC Converter if accurate AC voltage measurements are desired.

Features of the Model M-25 include:

1. Measuring rate: 1.1 sec/reading.

2. Multipurpose: measures DC volts, DC voltage ratios, and DC resistances (non-reactive).

3. Modular construction.

4. Long readout bulb life: All readout bulbs of the Model M-25 are powered by a regulated supply and switched by transistors, thus greatly limiting the surge current to a cold bulb filament.

5. Remote or local control of any or all of the following: "Scan" command, range, function, input filter.

6. Readout storage: The meter can be programmed for a new reading while the previous reading is being recorded.

VOLTS AC, Manual and Automatic Range Selection

a.	0.0000	-	0.9999
	1.0000	-	9.9990
b.	00.000	-	09.999
	10.000	-	99.990
c.	000.00	-	099.99
	100.00	-	999.90

ACCURACY

VOLTS DC: ± (.01% of reading + 1 digit)

RATIO: ± (.01% of reading + 1 digit)

OHMS: ± (.01% of reading + 1 digit)

Screwdriver-type calibration controls permit bringing instrument into agreement with user's standards.

PRIMARY POWER

115V ± 10V AC at 60 cps with earth ground available.

OPERATING TEMPERATURE

+32° F. to +125° F., ambient.

SECTION III - INSTALLATION AND OPERATION

GENERAL:

The Model M-25 digital multi-purpose meter consists of two modules, each 5-1/4" high and designed to be installed in a standard 19" rack or cabinet. Each module is completely enclosed and can be operated on the bench.

The logic module (or "A" unit) contains a mercury-wetted contact-relay-operated Wolff-Poggendorf voltage divider, the transistorized logic circuits that operate it, and the readout. The power and sensing module (or "B" unit) contains the power supply, the reference source, the sensing amplifier, and range and function switching relays. This unit is identified by the control knobs on the front panel.

Special precautions should be taken as to the physical attitude of the units. Both units contain mercury-wetted relays which cannot be operated at an angle of greater than 30° off of vertical. Therefore, after installation has been completed, the front panels should be within ± 30° vertical.

Upon completion of installation, check to see that there is sufficient clearance or air flow for convection cooling.

CABLE CONNECTIONS:

1. Connect the following inter-connecting, input, and control cables to the "A" and "B" units.

PURPOSE	PLUG IDENTITY	LOCATION
Power and logic	50 pin Winchester	A unit to B unit
Feedback	5 pin "AN" Connector	A unit to B unit
External Reference	4 pin "AN" Connector	B unit to external reference volts
Input	3 pin "AN" Connector	B unit to unknown input
*Printer Intelligence	75 pin Winchester	A unit to print device of remote readout
**AC-DC-Converter Control	34 pin Winchester	B unit to AC-DC Converter

*This cable is supplied only with a printer, adapter, or remote readout; otherwise a plug is supplied which can be wired to a recording device.

**This cable is supplied only with an AC-DC Converter; otherwise, a plug is supplied which can be wired to provide remote function control, as shown in Figure 1.

2. Connect the input cable to the input as follows:

Red clip (Pin A) to high-impedance side of signal to be measured.

Black clip (Pin B) to low-impedance or ground side of signal to be measured.

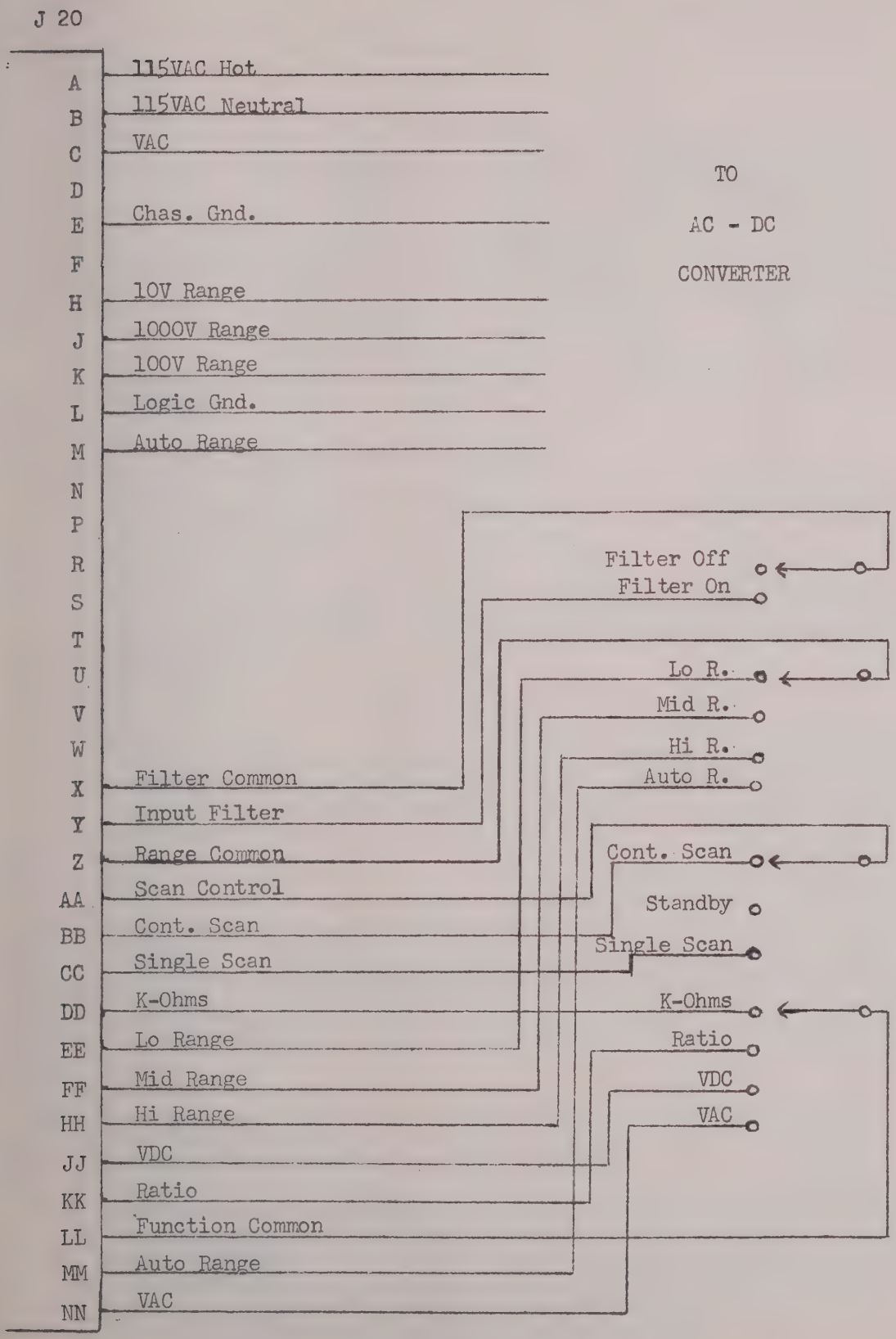


FIGURE 1
M-25 REMOTE CONTROL CONNECTIONS

Uninsulated clip (Pin C) to shield or chassis of the signal to be measured. The meter will operate best, if the black clip and the uninsulated clip are connected together. However, this is not always possible, since the uninsulated clip is tied to the chassis of the instrument and to the line power ground. It is necessary that less than 100 millivolts of AC exist between the black and the uninsulated clips when any measurement is being made.

3. Connect the external reference cable to the reference voltage, as follows:

Red clip (Pin A) to + voltage.

Black clip (Pin C) to reference ground (reference common).

Red-black clip (Pin B) to - voltage.

The reference voltage can be any magnitude from ± 10 VDC minimum to ± 100 VDC maximum. Loss of accuracy will result if these limits are exceeded.

CAUTION:

Do not connect the external reference, or have the POWER switch "ON" if the "A" or "B" units are not in the proper operating position. The external reference supply and/or the "B" unit may be damaged.

PRIMARY POWER:

The Model M-25 is designed to operate from a 105 to 125 volts 60 cps power source. The instrument is supplied with a polarized power cord to utilize earth ground. It is important that the polarization of the power receptacle is correct and that earth ground is present. In all model, earth ground of the power cord is connected to the chassis ground of each module.

FUSING:

The Model M-25 is provided with four active fuses. There are also four spare fuses located adjacent to the active fuses.

1. The line fuse is located at the rear of the "B" unit. The line fuse is a 3AG slo blo rated at 1 ampere which protects the instrument from high voltage, line overload, and/or shorts. When using an AC-DC converter this fuse and its spare should be replaced with 2 amp fuses. Two extra fuses are mounted inside the "B" unit on the rectifier assembly for this purpose.

2. The power supply fuses are 2 amp slo blo 3AG type. They are located inside the "B" unit on the rectifier assembly.

FRONT PANEL CONTROLS

POWER SWITCH:

1. Controls the 115 VAC 60 cps primary power to the instrument. Power is applied to the instrument for both "ON" and "PRINT" positions.

2. Controls the print command pulse and printer operation as follows: When the power switch is in the "Print" position, a 16 millisecond pulse (-15 VDC at up to 1 m.a. load) occurs at the end of the meter scan (the pulse appears at Pin #49 of the 75 pin connector at the rear of the "A" unit). This pulse is utilized to actuate the print recording device. Quiescent voltage is approximately - .5 VDC. Also, on the "Print" position, a momentary single-pole double-throw contact closure must occur in the printer to operate the meter in "Continuous" mode, (See description of MODE switch).

FUNCTION SWITCH:

1. Remote Position - For the purpose of transfering function control to a remote station.

2. Ohms Position - For the purpose of measuring non-reactive resistance values according to specifications.

3. Ratio Position - For the purpose of measuring DC voltage ratios according tc specifications. (See INSTALLATION - Cable Connections - For Reference Voltages.)

4. VDC - For the purpose of measuring Volts DC according to specifications.

5. VAC - Measures volts AC when the Model M-25 is used with an AC-DC converter.

MODE SWITCH:

1. Continuous - This position allows the meter to scan repeatedly at a rate of 1.1 sec/reading. If the POWER switch is in the "Print" position however, the meter will not scan a second time until "End of Print" information (in the form of a momentary, 10 m.s. min., SPDT contact closure) is received from the printer.

2. Standby - When the switch is placed in this position, the meter will complete the present scan and stop until a new scan command is given by momentarily placing the MODE switch to the "Single Scan" position.

RANGE SWITCH:

1. Remote Position - For the purpose of transfering range control to a remote station.

2. Low Position - For the purpose of locking the meter in its lowest most sensitive range.

3. Mid Position - Middle range.

4. High Position - Highest least sensitive range.

5. Auto Position - Meter will automatically select the most sensitive range of the meter consistant with the input.

INPUT FILTER:

1. Remote Position - For the purpose of transfering input filter control to a remote station.

2. Off Position - Input filter inactive.

3. On Position - Input filter active. The filter consists of two cascaded L-C sections and provides 60 db attenuation at 60 cps. When the M-25 is measuring resistances, the filter is automatically disconnected.

OPERATION

After the instrument has been installed and the operator has familiarized himself with the front panel controls, proceed as follows:

1. Set the POWER switch to "Off"; the RANGE switch to "AUTO"; and the FUNCTION switch to "VDC"; the FILTER switch to "On"; and the MODE switch to "Continuous Scan".

2. Short the input leads together.

3. Connect the primary power cord to a 115 VAC 60 cps polarized outlet.

4. Set the POWER switch to "On". The readout should illuminate, and the instrument should start scanning immediately.

5. After approximately one minute warm-up time, the instrument will read out ± 0.0000.

6. Allow an additional fifteen minutes of warm-up time before making any precision readings.

7. Set the MODE switch to "Standby", the FUNCTION switch to the particular type of reading to be taken, and connect the input leads to the unknown being measured. The reading can now be made once by momentarily setting the MODE switch to "Single Scan", or repeatedly by setting it to "Continuous Scan".

CAUTION:

Damage may result if voltages greater than the following are applied to the input terminals of the instrument:

1. 50 VDC or VAC with function switch on "Ohms".

2. 300 VDC or VAC with function switch on "VAC".

3. 300VDC or VAC with function switch on "Ratio" unless instrument is in the mid or high ranges.

4. 300 VDC or VAC with function switch on "VDC" unless instrument is in the mid or high ranges.

5. Under no conditions should more than 1000 VDC be applied to the input.

CAUTION: Do not attempt to measure the 115 VAC 60 cps line voltage while on D.C. function or on VAC unless caution is taken as to the polarization of the input leads.

REMOTE CONTROL OPERATION:

1. Function Selecting: Set the front panel FUNCTION switch to the "Remote" position. If the 34 pin connector at the rear of th "B" unit is wired per Figure 1, function control of Model M-25 is transferred to the remote function switch. Any function desired can be selected by turning the remote function switch to the proper position.

2. Mode Control: Set the Mode switch to the "Standby" position. Any mode of the MODE switch can now be duplicated as follows:

   a. Single Scan Operation can be remotely actuated by a momentary closure (10 m.s. min.) of contact "A" as shown in Figure 1. Contact "A" should be opened for at least 10 ms. before reclosing.

   b. Continuous scan can be obtained by a continuous closure of contact "B" (Figure 1).

3. Range Selection: Set the front panel RANGE switch to the "Remote" position. If the 34 pin connector on the rear of the "B" unit is wired per Figure 1, the range control is transferred to the remote range switch. Any range desired can be selected by turning the remote range switch to the proper position.

4. Filter Selection: Set the front panel FILTER switch to the "Remote" position. If the 34 pin connector on the rear of the "B" unit is wired per Figure 1, the input filter control is transferred to the remote filter switch. The input filter can then be turned on or off by the remote filter switch.

PRINT RECORDING OPERATION:

All of the information displayed in the readout is wired to the 75-pin connector located at the rear of the "A" unit. This information appears as a - 0.5 VDC on the pin representing the window of the readout being lit. All windows not illuminated have a quiescent voltage of - 27 VDC on their pins.

External connections to the 75-pin connector should be made using the - 27 VDC line as a common. The unit is then energized when the bulb is lit in the readout and the external load is on the readout buffer. Available current for external devices is 5 m.a. If the readout is removed, 45 m.a. (non-reactive) can be obtained. If it is desired to connect to ground as a common, the load will be in series with the readout bulb and the current will be limited to 20 m.a. However, because there are approximately 50 bulbs not lit and, therefore, a possible 50 energized loads with common ground, the load would be too great. Maximum total current from the plug should be limited to 200 milliamps.

Printing heads which plug directly into the 75-pin connector are available from NLS. Also, this type of intelligence can be used to drive an electronic serial converter for typewriters, etc.; otherwise, parallel or serial adapters, utilizing relays are used to convert the outputs from voltage representation to contact closures. The printing device is then connected to the Adapter. If the recorder has a common ground with the signal being measured by the Model M-25, a relay adapter must be used to eliminate ground loops.

With all types of printing systems, proceed as follows:

1. Connect the entire print recording system to the Model M-24. For a continuous print mode of operation, the printer being used should have a momentary SPDT contact closure, actuated for 10 m.s. (min.) when the printing is completed. This is mentioned in case the operator is using a printer other than one supplied by NLS.

2. After the instrument has been allowed to warm up, set the MODE switch to "Standby" and the POWER switch to "Print", in that order. All front panel and remote control operation remains

the same except, possibly, the "Continuous Scan" mode. It may be necessary to actuate the "Single Scan" mode O N C E before setting for "Continuous Scan" so that a capacitor in the "B" unit will charge, insuring operation of the "Continuous" mode.

Because the meter now "waits" for the printer, the scanning period will change. Therefore, depending upon the speed of the printer being used, the number of readings taken per second will drop when the operator switches to the "Print" position of the POWER switch.

REMOTE READOUT:

The 75-pin connector at the rear of the "A" unit can also be used to connect a remote readout. Model M-25 readout circuits are not designed to accommodate two readouts; so the local readout must be removed before connecting the remote readout.

SECTION IV - CALIBRATION PROCEDURE

N-25 STANDARD

Equipment Required:

1. Two voltage dividers, one with 10:1 ratio, one with 100:1 ratio; each divider calibrated for a 10 megohm load; each at least ± .005% accurate.

2. Stable but not necessarily accurate DC sources of 90 to 99.99, and 900 to 999.9 volts DC.

3. Stable and accurate to ± .005% DC source of between 9 and 9.999 volts DC. Nine standard cells calibrated for a 10 megohm load is recommended.

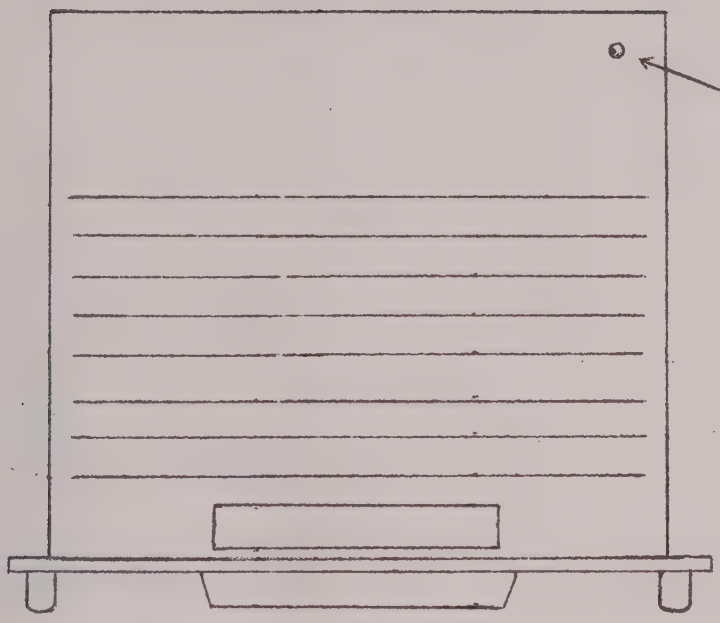
4. Stable and accurate to ± .005% resistors between 9 to 9.999, 90 to 99.99, and 900 to 999.9 kilohms.

Prodedure:

Allow the instrument to warm up for thirty minutes; remove the top covers. Follow the steps in the table in the sequence listed. The location of each adjustment potentiometer is shown in Figure 2.

STEP NO.	MODE	SOURCE	RATIO	READOUT DISPLAY	ADJUSTMENT	PURPOSE
1	VDC/AUTO	Input Leads Shorted		± 0.0000 DC	R6 (amp)	DC Offset
2R		90V	10:1	9V		
3		90V	1:1	90V	R2 (amp)	Ranging
4R		900V	100:1	9V		
5		900V	1:1	900V	R1 (amp)	Ranging
6	VDC/AUTO	9 Std. Cells	---	9V	R3 (ref)	Prime
7	1 MEG/AUTO	Input Leads Shorted		0.0000K ohms	R45 ("A" Unit)	Input Lead Compensation
8		9K ohms	---	9K ohms	R5 (amp)	Prime
9		90K ohms	---	90K ohms	R4 (amp)	Prime
10	1 MEG/AUTO	900K ohms	---	900K ohms	R3 (amp)	Prime

NOTES:
1. The readout in Steps 2 and 3 should have digital correspondence (without regard for decimal-point position) within specifications. The same requirement also applies to Steps 4 and 5.
2. "R" in the Step No. column means record the reading. The following step should show digital correspondence.
3. On Steps 6, 8, 9, and 10 the readout should agree with the calibrated inputs.



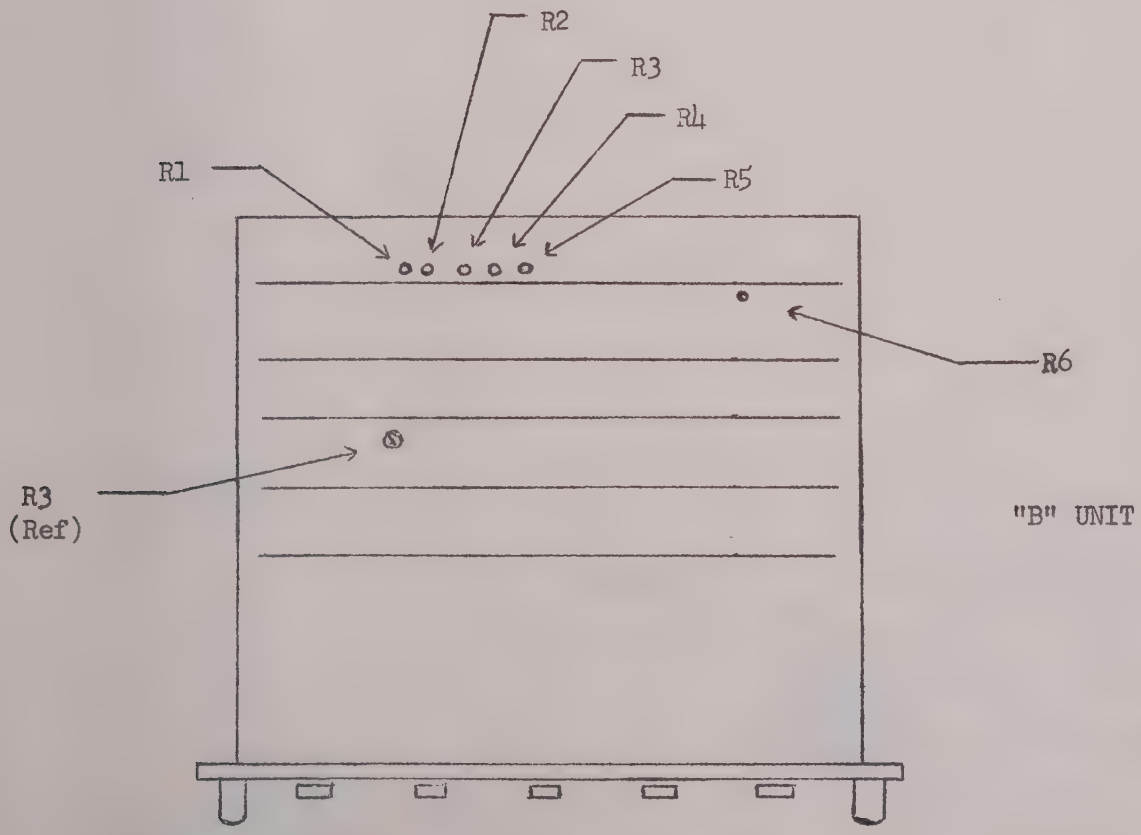
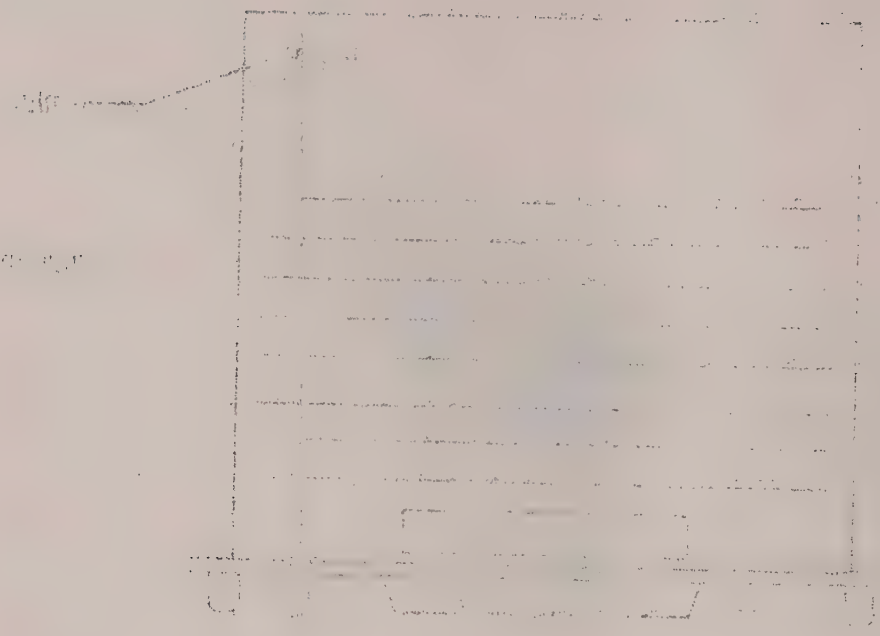
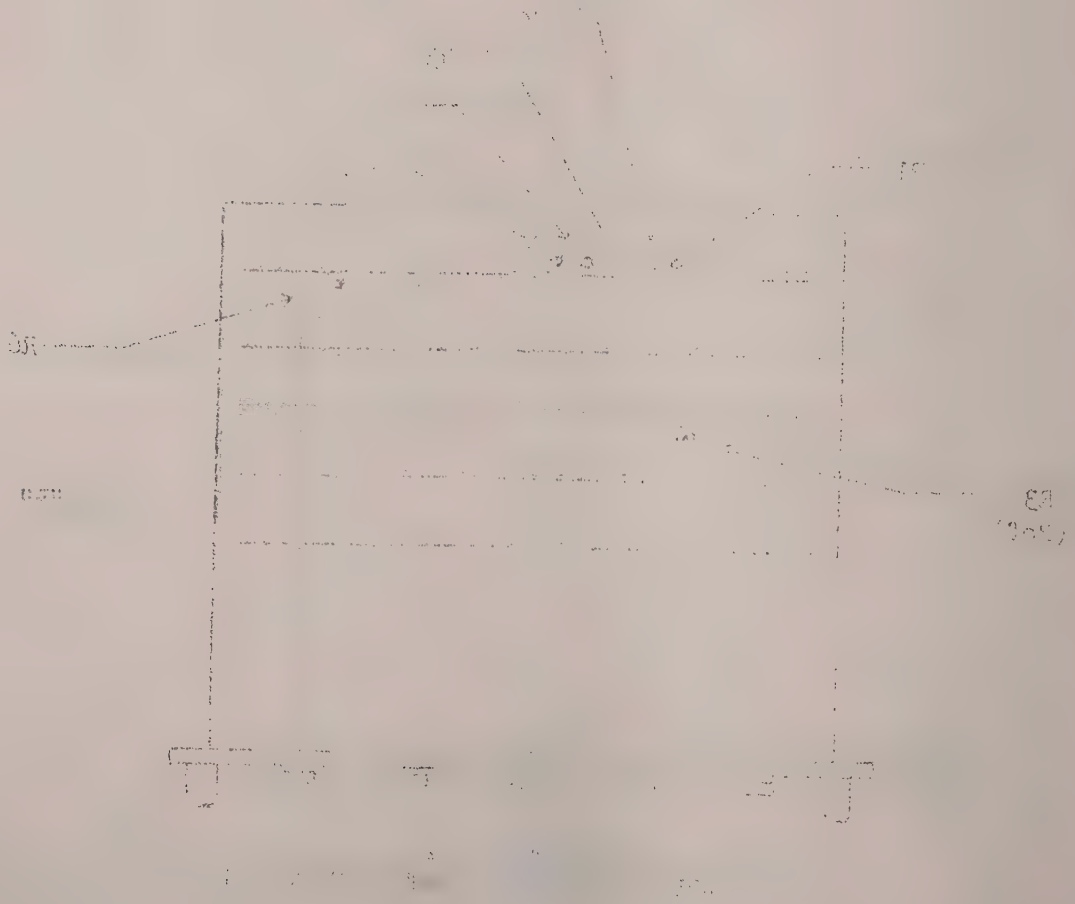


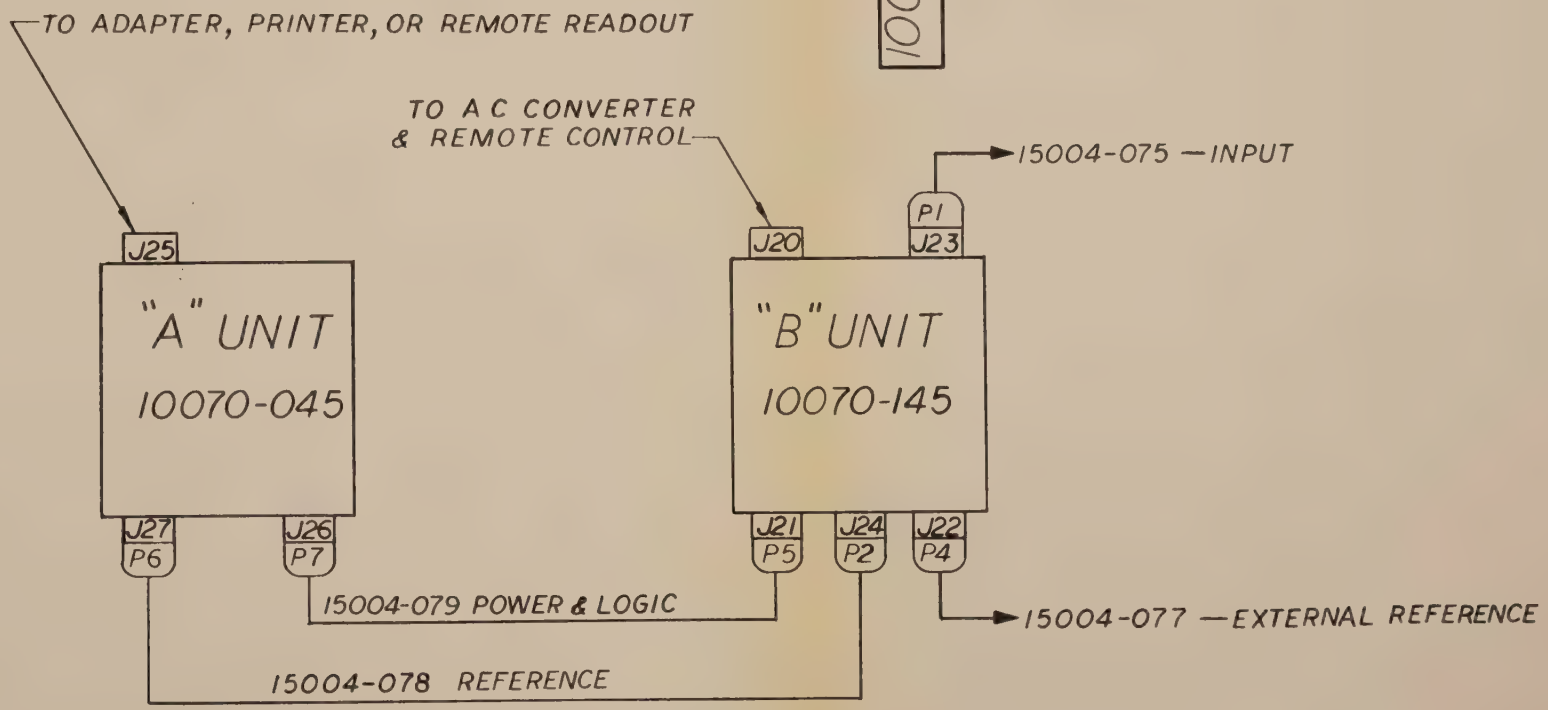
FIGURE 2
ADJUSTMENT POTENTIOMETER LOCATIONS





10070 SHEET 4

REVISIONS				
SYM.	EFFECT.	DESCRIPTION	DATE	APPROVAL



NEXT ASSY	USED ON	NEXT ASSY	FINAL ASSY
APPLICATION		QTY REQD	

UNLESS OTHERWISE SPECIFIED	DRAWN BY H. BRINLEY	DATE 2-16-62
DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTION ± DECIMAL ± ANGLES ±	CHECKED BY	DATE
	APPROVED BY R. JOHNSON	DATE 2-21-62
MATERIAL	FINISH	

TITLE

CABLING DIAGRAM

MODEL M25

SCALE | WT.

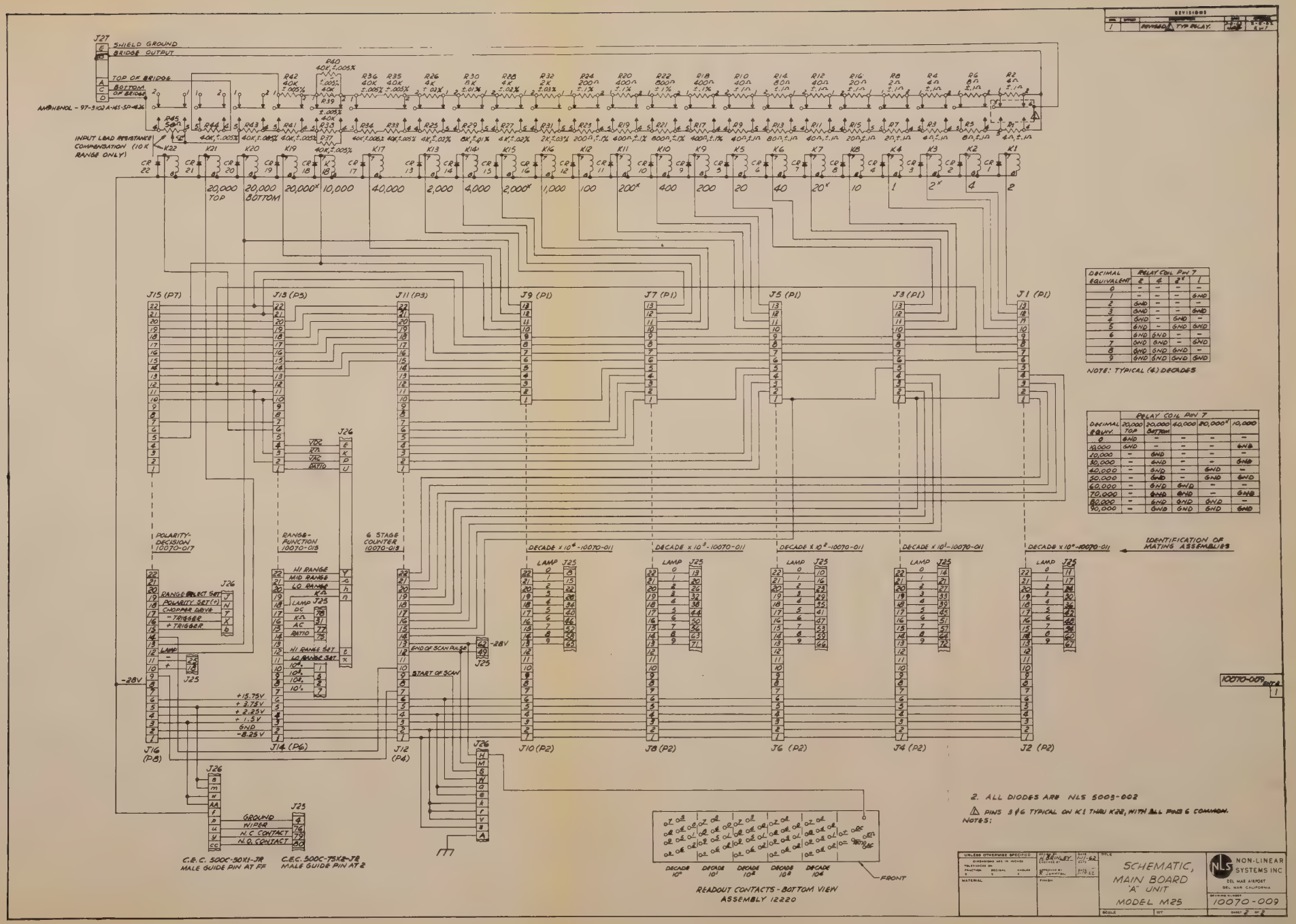
NON-LINEAR SYSTEMS INC.
DEL MAR AIRPORT
DEL MAR, CALIFORNIA

DRAWING NUMBER 10070

SHEET 4 OF

NOTE

1. MATING PLUGS FOR J20 & J25 ARE SUPPLIED WITH INSTRUMENT.



DECIMAL EQUIVALENT	RELAY COIL PIN 7			
	2	4	8	1
0	–	–	–	–
1	–	–	–	GND
2	GND	–	–	–
3	GND	–	–	GND
4	GND	–	GND	–
5	GND	–	GND	GND
6	GND	GND	–	–
7	GND	GND	–	GND
8	GND	GND	GND	–
9	GND	GND	GND	GND

NOTE: TYPICAL (4) DECADES

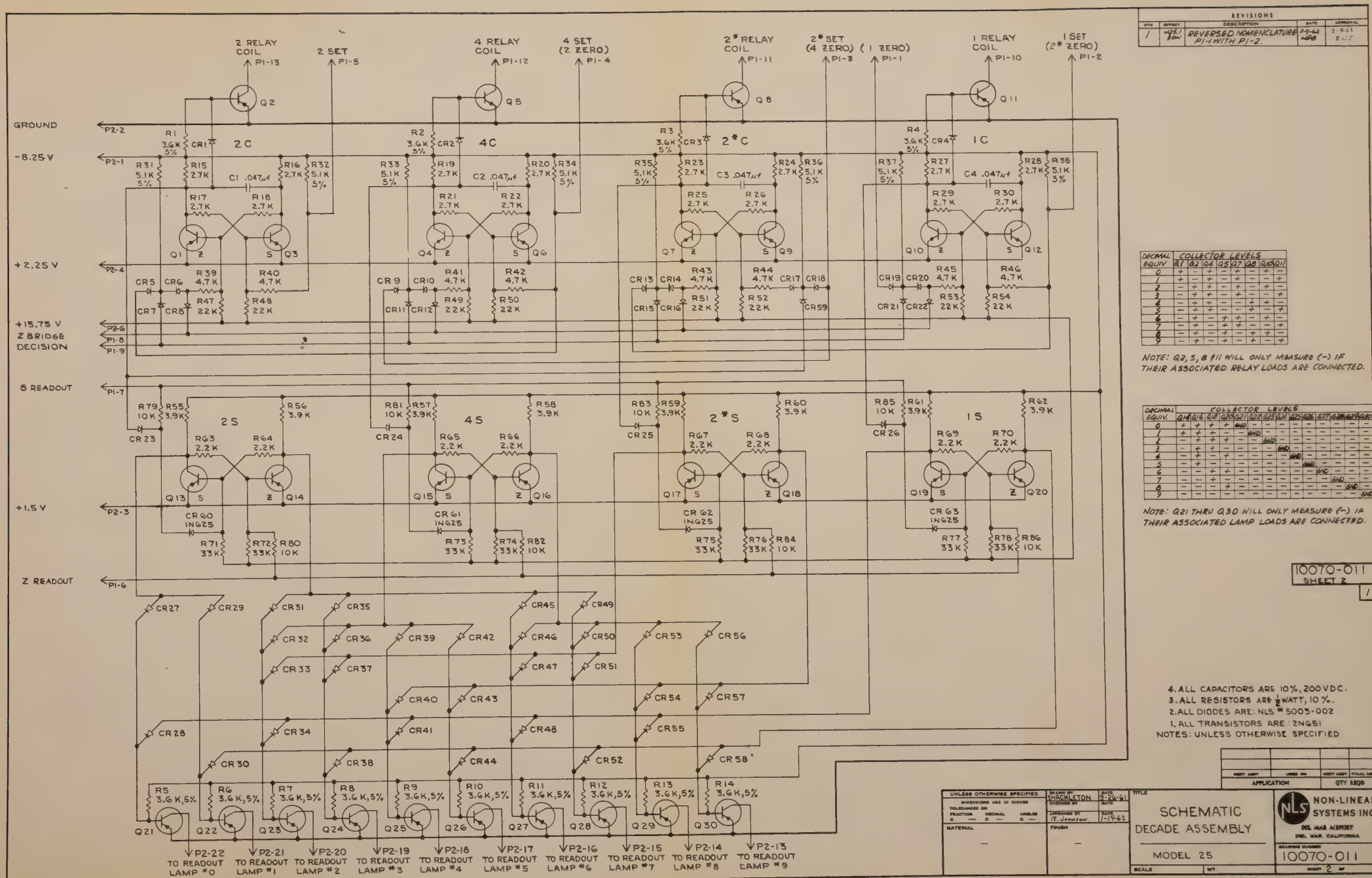
DECIMAL EQUIV.	RELAY COIL PIN 7				
	20,000 TOP	20,000 BOTTOM	40,000	80,000^X	10,000
0	GND	–	–	–	–
10,000	GND	–	–	–	GND
10,000	–	GND	–	–	–
30,000	–	GND	–	–	GND
40,000	–	GND	–	GND	–
50,000	–	GND	–	GND	GND
60,000	–	GND	GND	–	–
70,000	–	GND	GND	–	GND
80,000	–	GND	GND	GND	–
90,000	–	GND	GND	GND	GND

2. ALL DIODES ARE NLS 5003-002

⚠ PINS 3 & 6 TYPICAL ON K1 THRU K28, WITH ALL PINS 6 COMMON.

NOTES:

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON:
FRACTION ± DECIMAL ± ANGLES ±
MATERIAL
FINISH
DRAWN N. STANLEY 7-62
CHECKED
APPROVED
TITLE
SCHEMATIC, MAIN BOARD 'A' UNIT MODEL M25
NON-LINEAR SYSTEMS INC
DEL MAR AIRPORT
DEL MAR, CALIFORNIA
DRAWING NUMBER 10070-009
SCALE
SHEET 2 OF 2



REVISIONS				
SYM	EFFECT	DESCRIPTION	DATE	APPROVAL
1	#32,1 #34	REVERSED NOMENCLATURE P1-1 WITH P1-2.	7-9-62 WB	1-9-63 R.J.S

DECIMAL EQUIV	COLLECTOR LEVELS Q1	Q2	Q4	Q5	Q7	Q8	Q10	Q11
0	+	–	+	–	+	–	+	–
1	+	–	+	–	+	–	–	+
2	–	+	+	–	+	–	+	–
3	–	+	+	–	+	–	–	+
4	–	+	+	–	–	+	+	–
5	–	+	+	–	–	+	–	+
6	–	+	–	+	+	–	+	–
7	–	+	–	+	+	–	–	+
8	–	+	–	+	–	+	+	–
9	–	+	–	+	–	+	–	+

NOTE: Q2, 5, 8 & 11 WILL ONLY MEASURE (–) IF THEIR ASSOCIATED RELAY LOADS ARE CONNECTED.

DECIMAL EQUIV.	COLLECTOR LEVELS Q14	Q16	Q18	Q20	Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30
0	+	+	+	+	GND	–	–	–	–	–	–	–	–	–
1	+	+	+	–	–	GND	–	–	–	–	–	–	–	–
2	–	+	+	+	–	–	GND	–	–	–	–	–	–	–
3	–	+	+	–	–	–	–	GND	–	–	–	–	–	–
4	–	+	–	+	–	–	–	–	GND	–	–	–	–	–
5	–	+	–	–	–	–	–	–	–	GND	–	–	–	–
6	–	–	+	+	–	–	–	–	–	–	GND	–	–	–
7	–	–	+	–	–	–	–	–	–	–	–	GND	–	–
8	–	–	–	+	–	–	–	–	–	–	–	–	GND	–
9	–	–	–	–	–	–	–	–	–	–	–	–	–	GND

NOTE: Q21 THRU Q30 WILL ONLY MEASURE (–) IF THEIR ASSOCIATED LAMP LOADS ARE CONNECTED.

10070-011
SHEET 2
1

4. ALL CAPACITORS ARE 10%, 200 VDC.
3. ALL RESISTORS ARE ½ WATT, 10%.
2. ALL DIODES ARE: NLS # 5003-002
1. ALL TRANSISTORS ARE: 2N651
NOTES: UNLESS OTHERWISE SPECIFIED

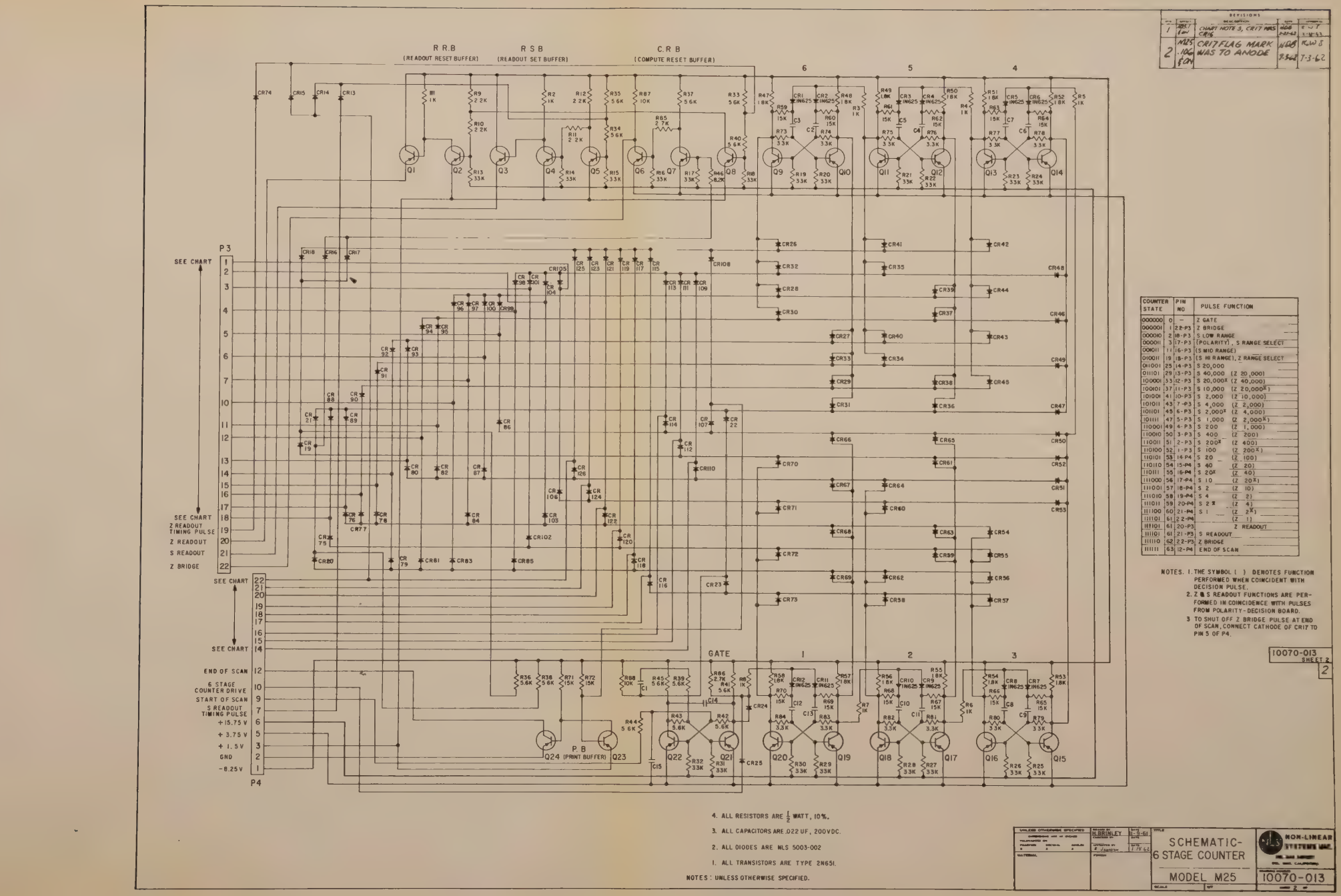
MFGR'S ASSY	USED ON	MFGR'S ASSY	FINAL ASSY
APPLICATION		QTY REQD	

UNLESS OTHERWISE SPECIFIED	DRAWN BY SHACKLETON	DATE 3-26-62
DIMENSIONS ARE IN INCHES	CHECKED BY	
TOLERANCES ON FRACTION ± DECIMAL ± ANGLES ±	APPROVED BY R. Johnson	DATE 1-14-62
MATERIAL –	FINISH –	

TITLE
SCHEMATIC
DECADE ASSEMBLY
MODEL 25
SCALE WT.

NLS NON-LINEAR SYSTEMS INC.
DEL MAR AIRPORT
DEL MAR, CALIFORNIA

DRAWING NUMBER
10070-011
SHEET 2 OF



COUNTER STATE	PIN NO	PULSE FUNCTION
000000	0	— Z GATE
000001	1	22-P3 Z BRIDGE
000010	2	18-P3 S LOW RANGE
000011	3	17-P3 (POLARITY), S RANGE SELECT
000111	11	16-P3 (S MID RANGE)
010011	19	15-P3 (S HI RANGE), Z RANGE SELECT
011001	25	14-P3 S 20,000
011101	29	13-P3 S 40,000 (Z 20,000)
100001	33	12-P3 S 20,000[X] (Z 40,000)
100101	37	11-P3 S 10,000 (Z 20,000[X])
101001	41	10-P3 S 2,000 (Z 10,000)
101011	43	7-P3 S 4,000 (Z 2,000)
101101	45	6-P3 S 2,000[X] (Z 4,000)
101111	47	5-P3 S 1,000 (Z 2,000[X])
110001	49	4-P3 S 200 (Z 1,000)
110010	50	3-P3 S 400 (Z 200)
110011	51	2-P3 S 200[X] (Z 400)
110100	52	1-P3 S 100 (Z 200[X])
110101	53	14-P4 S 20 (Z 100)
110110	54	15-P4 S 40 (Z 20)
110111	55	16-P4 S 20[X] (Z 40)
111000	56	17-P4 S 10 (Z 20[X])
111001	57	18-P4 S 2 (Z 10)
111010	58	19-P4 S 4 (Z 2)
111011	59	20-P4 S 2[X] (Z 4)
111100	60	21-P4 S 1 (Z 2[X])
111101	61	22-P4 (Z 1)
111101	61	20-P3 Z READOUT
111101	61	21-P3 S READOUT
111110	62	22-P3 Z BRIDGE
111111	63	12-P4 END OF SCAN

NOTES. 1. THE SYMBOL ( ) DENOTES FUNCTION PERFORMED WHEN COINCIDENT WITH DECISION PULSE.
2. Z & S READOUT FUNCTIONS ARE PERFORMED IN COINCIDENCE WITH PULSES FROM POLARITY-DECISION BOARD.
3 TO SHUT OFF Z BRIDGE PULSE AT END OF SCAN, CONNECT CATHODE OF CR17 TO PIN 5 OF P4.

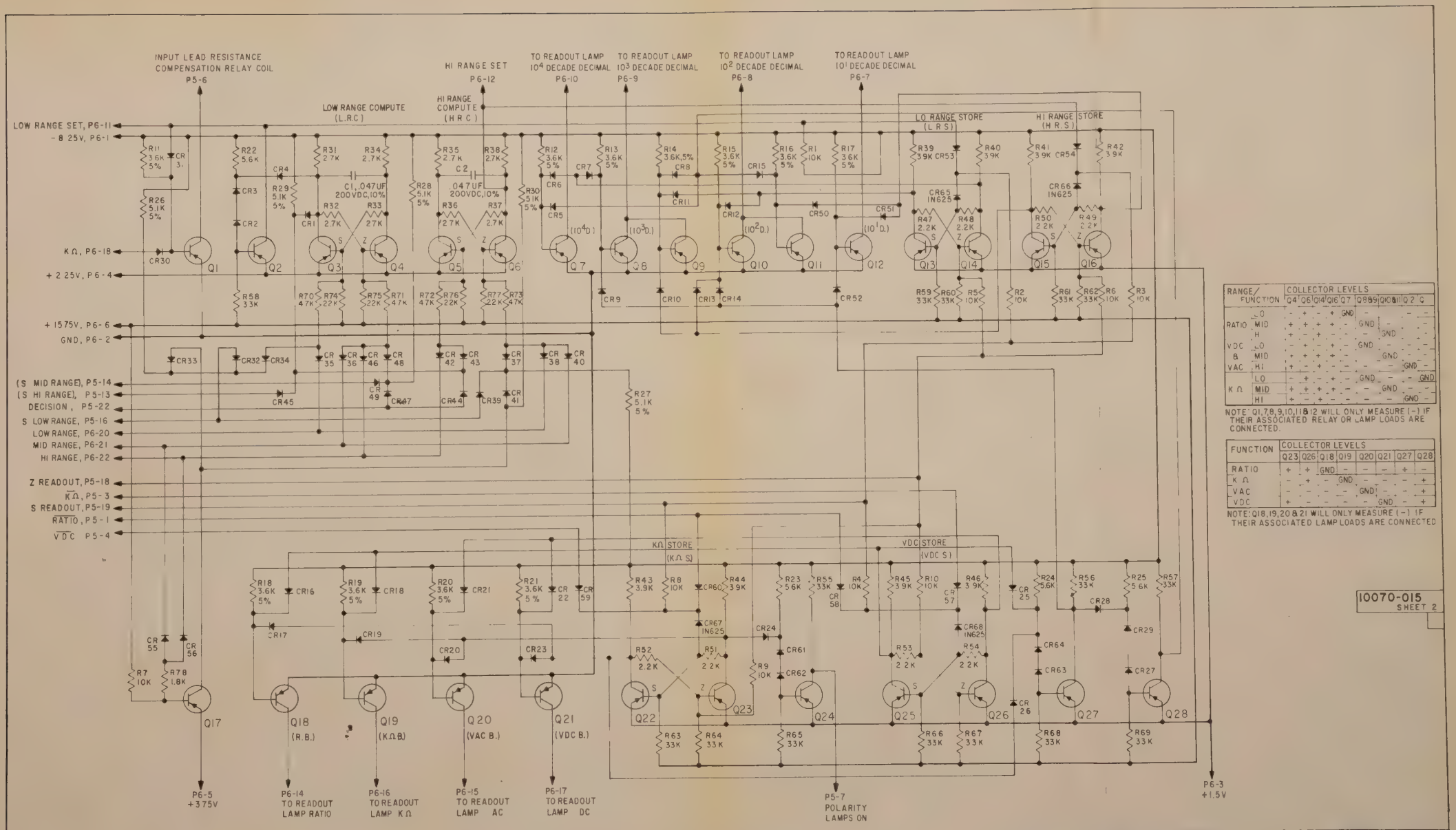
4. ALL RESISTORS ARE $\frac{1}{2}$ WATT, 10%.
3. ALL CAPACITORS ARE .022 UF, 200VDC.
2. ALL DIODES ARE NLS 5003-002
1. ALL TRANSISTORS ARE TYPE 2N651.

NOTES: UNLESS OTHERWISE SPECIFIED.

REVISIONS					
1	2001 for	CHART NOTE 3, CR17 WAS CR16	WDB	6-1-62	
2	M25 100 for	CR17 FLAG MARK WAS TO ANODE	WDB	7-3-62	

10070-013 SHEET 2

UNLESS OTHERWISE SPECIFIED	DRAWN BY H. BRINLEY	DATE 11-3-61	TITLE SCHEMATIC- 6 STAGE COUNTER MODEL M25
	CHECKED BY		NON-LINEAR SYSTEMS INC.
	APPROVED BY	DATE 11-14-61	DRAWING NUMBER 10070-013
			SCALE SIZE



RANGE/FUNCTION		COLLECTOR LEVELS Q4	Q6	Q14	Q16	Q7	Q8	Q9	Q10	Q11	Q12	Q
RATIO	LO	-	+	-	+	GND	-					-
	MID	+	+	+	+	-	GND	-				-
	HI	+	-	+	-	-	-	GND	-			-
VDC	LO	-	+	-	+	-	GND	-				-
	MID	+	+	+	+	-	-	GND	-			-
	HI	+	-	+	-	-	-	-	GND	-		-
KΩ	LO	-	+	-	+	-	GND	-			-	GND
	MID	+	+	+	+	-	-	GND	-			-
	HI	+	-	+	-	-	-	-	GND	-		-

NOTE: Q1,7,8,9,10,11&12 WILL ONLY MEASURE (-) IF THEIR ASSOCIATED RELAY OR LAMP LOADS ARE CONNECTED.

FUNCTION	COLLECTOR LEVELS Q23	Q26	Q18	Q19	Q20	Q21	Q27	Q28
RATIO	+	+	GND	-	-	-	+	-
KΩ	-	+	-	GND	-	-	-	+
VAC	-	-	-	-	GND	-	-	+
VDC	+	-	-	-	-	GND	-	+

NOTE: Q18,19,20 & 21 WILL ONLY MEASURE (-) IF THEIR ASSOCIATED LAMP LOADS ARE CONNECTED

10070-015
SHEET 2

3. ALL DIODES ARE NLS 5003-002.

2. ALL TRANSISTORS ARE TYPE 2N651.

1. ALL RESISTORS ARE $\frac{1}{2}$ WATT, 10%.

NOTES: UNLESS OTHERWISE SPECIFIED.

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTION ± DECIMAL ± ANGLES ±
MATERIAL
FINISH

DRAWN BY H. BRINLEY DATE 12-12-61
CHECKED BY
APPROVED BY J. Jourdan DATE 1-14-62

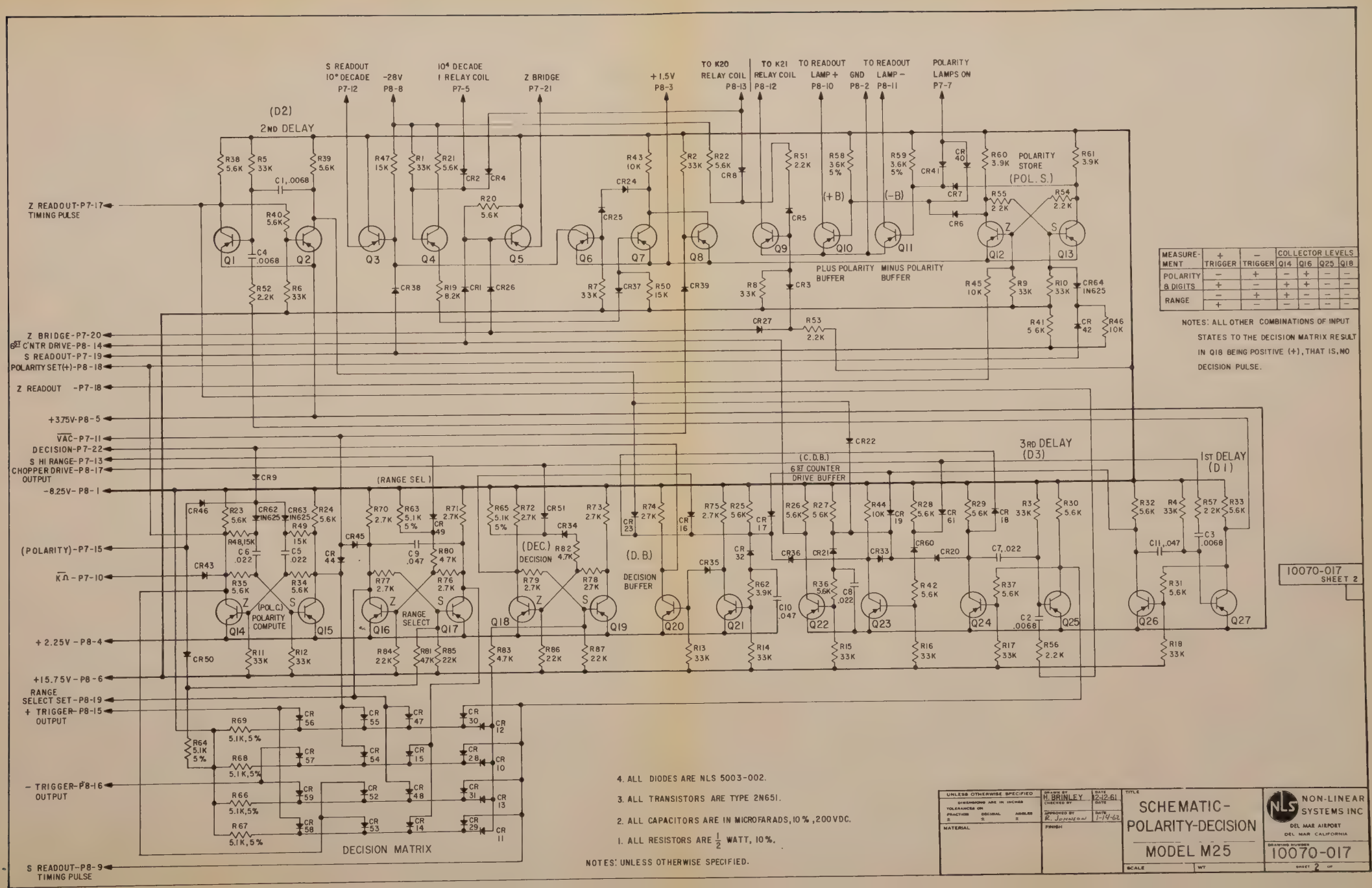
TITLE
SCHEMATIC - RANGE - FUNCTION
MODEL M25

SCALE WT

NON-LINEAR SYSTEMS INC
DEL MAR AIRPORT
DEL MAR CALIFORNIA

DRAWING NUMBER
10070-015

SHEET 2 OF



MEASUREMENT	+ TRIGGER	− TRIGGER	COLLECTOR LEVELS Q14	Q16	Q25	Q18
POLARITY & DIGITS	−	+	−	+	−	−
	+	−	+	+	−	−
RANGE	−	+	+	−	−	−
	+	−	−	−	−	−

NOTES: ALL OTHER COMBINATIONS OF INPUT STATES TO THE DECISION MATRIX RESULT IN Q18 BEING POSITIVE (+), THAT IS, NO DECISION PULSE.

10070-017 SHEET 2

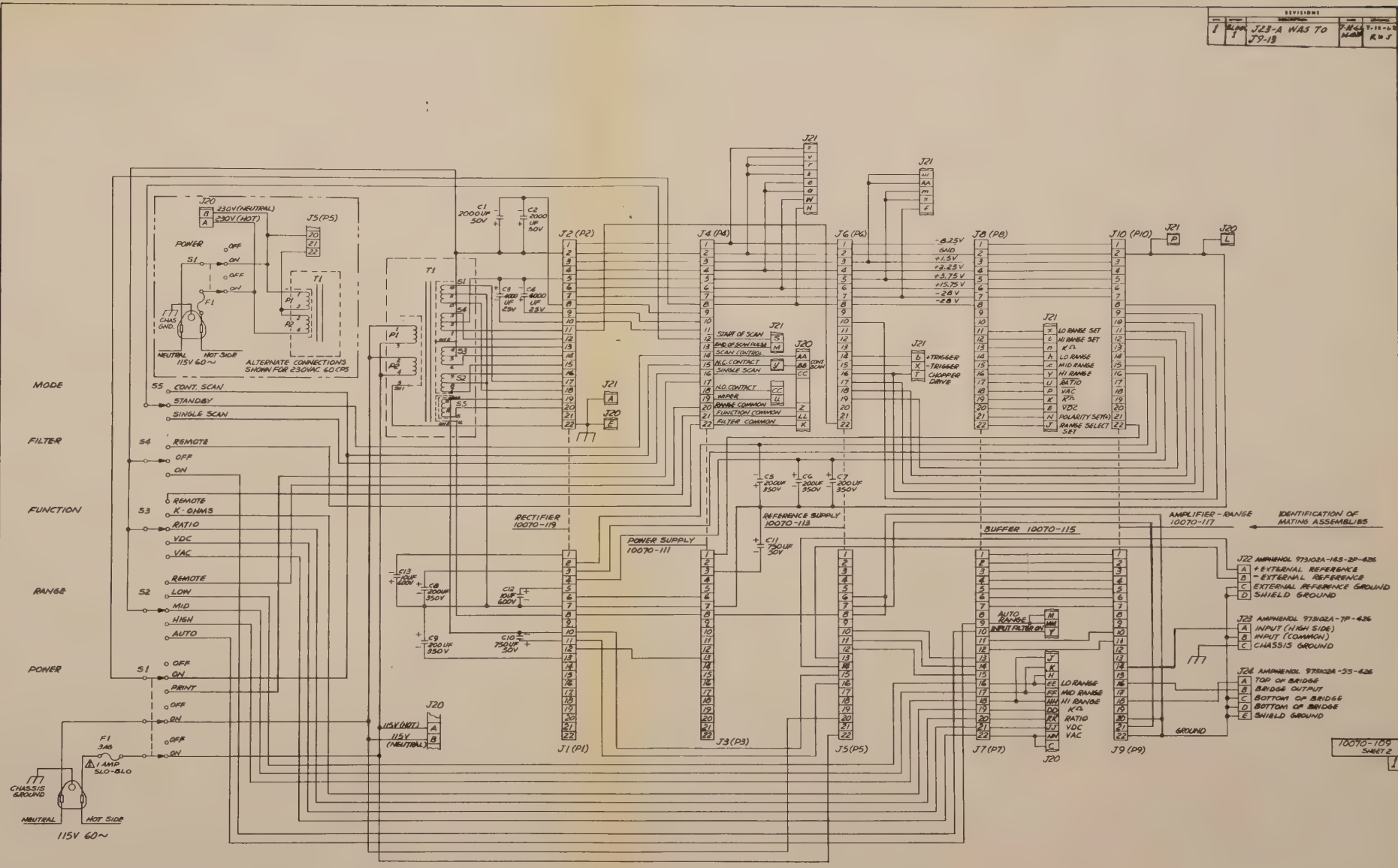
4. ALL DIODES ARE NLS 5003-002.
3. ALL TRANSISTORS ARE TYPE 2N651.
2. ALL CAPACITORS ARE IN MICROFARADS, 10%, 200VDC.
1. ALL RESISTORS ARE ½ WATT, 10%.

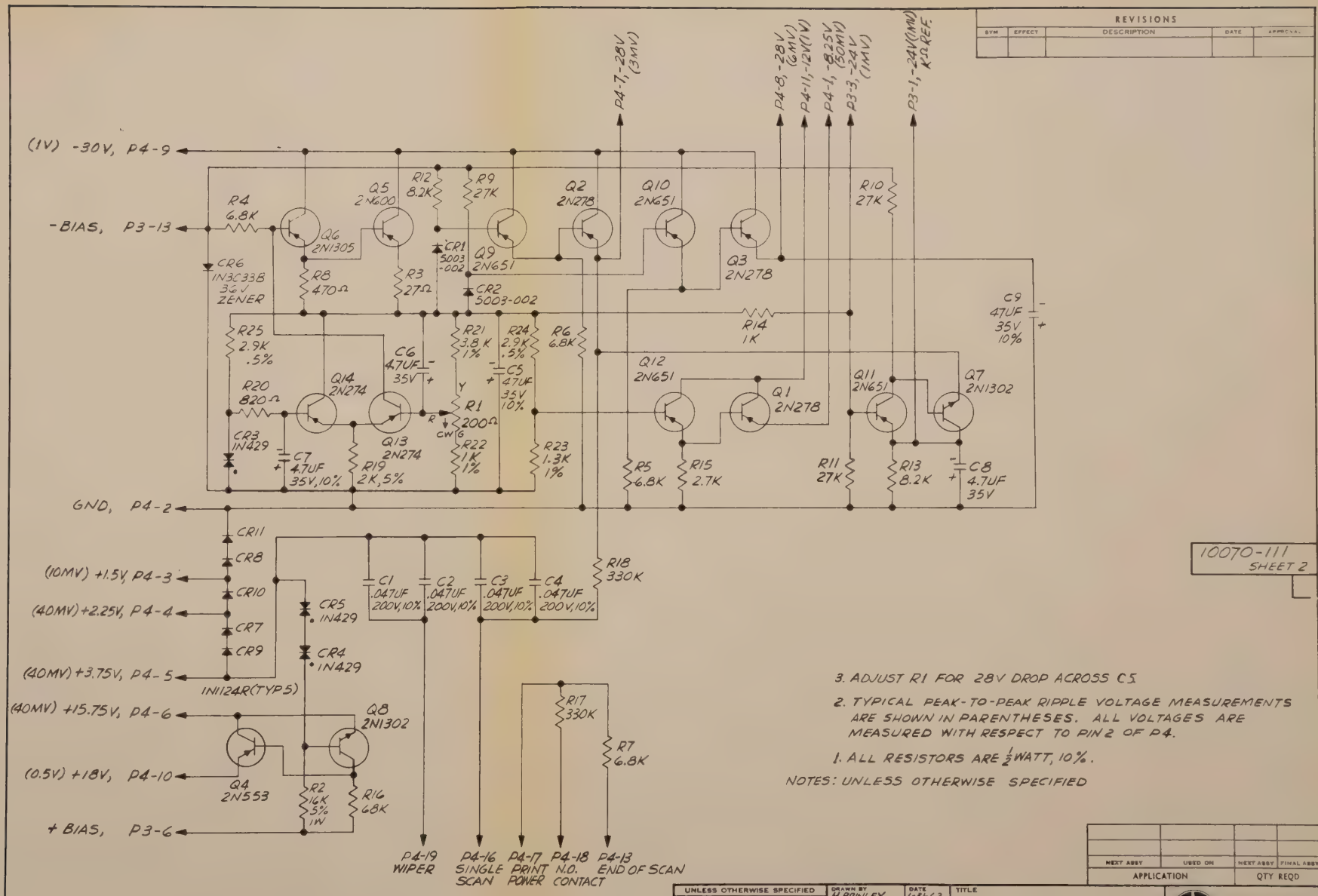
NOTES: UNLESS OTHERWISE SPECIFIED.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ± DECIMAL ± ANGLES ±	DRAWN BY H. BRINLEY	DATE 12-12-61	TITLE SCHEMATIC-POLARITY-DECISION MODEL M25
MATERIAL	CHECKED BY	DATE	
	APPROVED BY R. JOHNSON	DATE 1-14-62	
	FINISH		SCALE WT

NON-LINEAR SYSTEMS INC
DEL MAR AIRPORT
DEL MAR CALIFORNIA

DRAWING NUMBER 10070-017
SHEET 2 OF


REVISIONS
J28-A WAS TO J9-19
MODE
FILTER
FUNCTION
RANGE
POWER
S5 CONT. SCAN
STANDBY
SINGLE SCAN
S4 REMOTE
OFF
ON
S3 REMOTE
K-OHMS
RATIO
VDC
VAC
S2 REMOTE
LOW
MID
HIGH
AUTO
S1 OFF
ON
PRINT
OFF
ON
OFF
ON
F1 3AG 1 AMP SLO-BLO
CHASSIS GROUND
NEUTRAL
HOT SIDE
115V 60~
J20 230V (NEUTRAL) 230V (HOT)
J5 (P5)
POWER
S1
F1
T1
P1
P2
CHAS. GND.
NEUTRAL 115V 60~
HOT SIDE
ALTERNATE CONNECTIONS SHOWN FOR 230VAC 60 CPS
C1 2000 UF 50V
C2 2000 UF 50V
C3 4000 UF 25V
C4 4000 UF 25V
C5 200UF 350V
C6 200UF 350V
C7 200 UF 350V
C8 200UF 350V
C9 200 UF 350V
C10 750UF 50V
C11 750UF 50V
C12 10UF 600V
C13 FILM 600V
J2 (P2)
J4 (P4)
J6 (P6)
J8 (P8)
J10 (P10)
J21
J20
START OF SCAN
END OF SCAN PULSE
SCAN CONTROL
N.C. CONTACT
SINGLE SCAN
N.O. CONTACT
HOPPER
RANGE COMMON
FUNCTION COMMON
FILTER COMMON
CONT. SCAN
-8.25V
GND
+1.5V
+2.25V
+3.75V
+15.75V
-28V
-28V
+TRIGGER
-TRIGGER
CHOPPER DRIVE
LO RANGE SET
HI RANGE SET
KΩ
LO RANGE
MID RANGE
HI RANGE
RATIO
VAC
KΩ
VDC
POLARITY SET(S)
RANGE SELECT SET
RECTIFIER 10070-119
POWER SUPPLY 10070-111
REFERENCE SUPPLY 10070-113
BUFFER 10070-115
AMPLIFIER-RANGE 10070-117
IDENTIFICATION OF MATING ASSEMBLIES
J1 (P1)
J3 (P3)
J5 (P5)
J7 (P7)
J9 (P9)
AUTO RANGE
INPUT FILTER ON
LO RANGE
MID RANGE
HI RANGE
KΩ
RATIO
VDC
VAC
GROUND
J22 AMPHENOL 97B102A-14S-2P-426
+EXTERNAL REFERENCE
-EXTERNAL REFERENCE
EXTERNAL REFERENCE GROUND
SHIELD GROUND
J23 AMPHENOL 97B102A-7P-426
INPUT (HIGH SIDE)
INPUT (COMMON)
CHASSIS GROUND
J24 AMPHENOL 97B102A-5S-426
TOP OF BRIDGE
BRIDGE OUTPUT
BOTTOM OF BRIDGE
BOTTOM OF BRIDGE
SHIELD GROUND
10070-109 SHEET 2
2. CAUTION: HIGH VOLTAGE PRESENT ON MAIN BOARD.
⚠ WHEN OPERATING M25 WITH 125E AC/DC CONVERTER CHANGE F1 FROM 1 AMP SLO-BLO TO 2 AMP SLO-BLO
NOTES:
SCHEMATIC, MAIN BOARD "B" UNIT MODEL M25
NON-LINEAR SYSTEMS INC.
DEL MAR AIRPORT
DEL MAR, CALIFORNIA
10070-109



10070-111
SHEET 2

3. ADJUST R1 FOR 28V DROP ACROSS C5

2. TYPICAL PEAK-TO-PEAK RIPPLE VOLTAGE MEASUREMENTS ARE SHOWN IN PARENTHESES. ALL VOLTAGES ARE MEASURED WITH RESPECT TO PIN 2 OF P4.

1. ALL RESISTORS ARE ½ WATT, 10%.

NOTES: UNLESS OTHERWISE SPECIFIED

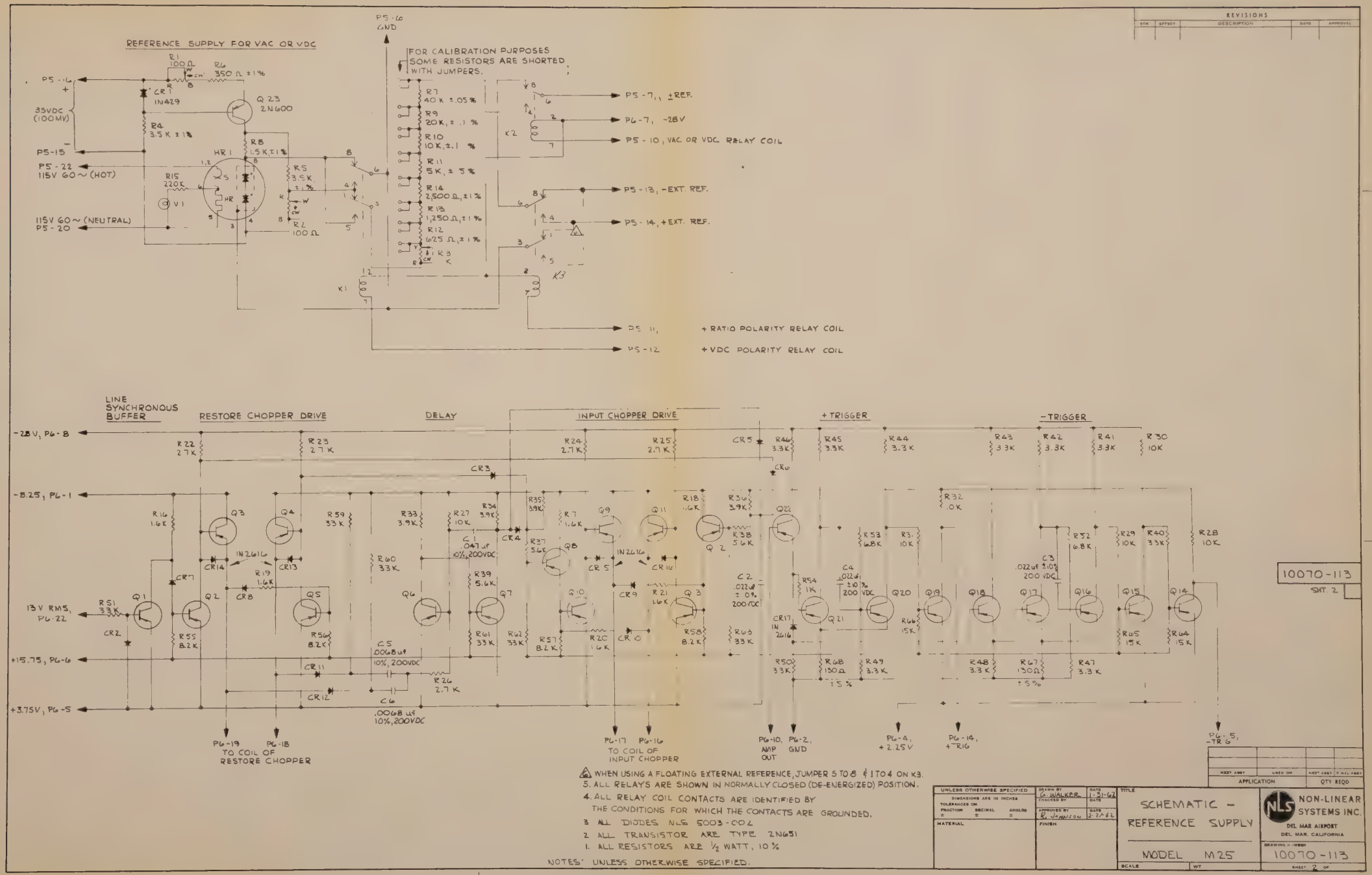
NEXT ASSY	USED ON	NEXT ASSY	FINAL ASSY
APPLICATION		QTY REQD	

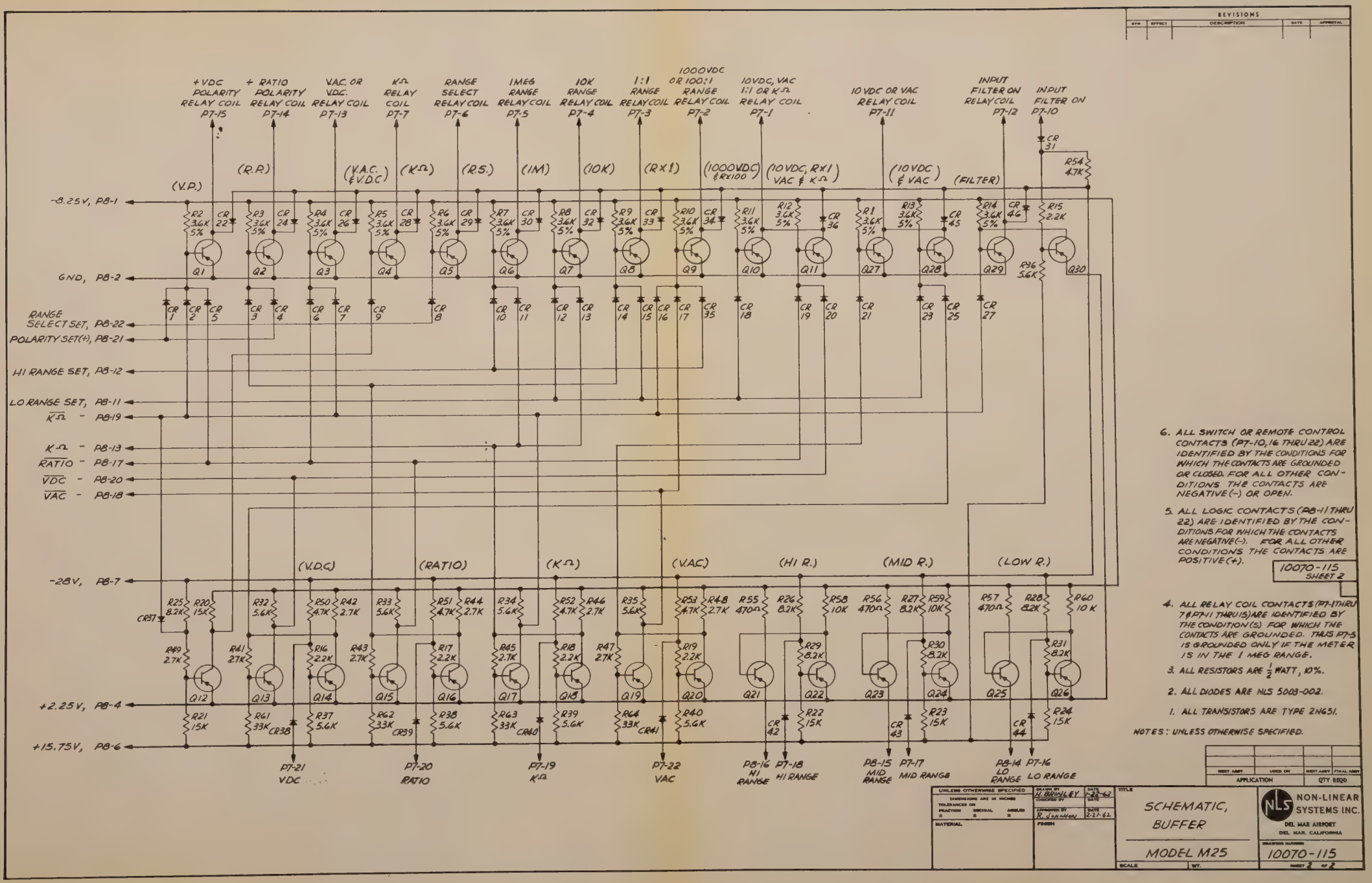
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES; TOLERANCES ON FRACTIONS ± DECIMAL ± ANGLES ±	DRAWN BY H. BRINLEY	DATE 1-31-62	TITLE: SCHEMATIC - POWER SUPPLY
	CHECKED BY	DATE	
	APPROVED BY P. JOHNSON	DATE 2-21-62	MODEL M25
MATERIAL	FINISH		SCALE / WT.

NON-LINEAR SYSTEMS INC.
DEL MAR AIRPORT
DEL MAR, CALIFORNIA

DRAWING NUMBER 10070-111

SHEET 2 OF 2


REFERENCE SUPPLY FOR VAC OR VDC
P5-16
35VDC (100MV)
P5-15
P5-22 115V 60~ (HOT)
115V 60~ (NEUTRAL) P5-20
P5-6 GND
FOR CALIBRATION PURPOSES SOME RESISTORS ARE SHORTED WITH JUMPERS.
P5-7, ±REF.
P6-7, -28V
P5-10, VAC OR VDC RELAY COIL
P5-13, -EXT. REF.
P5-14, +EXT. REF.
P5-11, +RATIO POLARITY RELAY COIL
P5-12, +VDC POLARITY RELAY COIL
LINE SYNCHRONOUS BUFFER
RESTORE CHOPPER DRIVE
DELAY
INPUT CHOPPER DRIVE
+TRIGGER
-TRIGGER
-28V, P6-8
-8.25, P6-1
13V RMS, P6-22
+15.75, P6-6
+3.75V, P6-5
P6-19 P6-18 TO COIL OF RESTORE CHOPPER
P6-17 P6-16 TO COIL OF INPUT CHOPPER
P6-10, AMP OUT
P6-2, GND
P6-4, +2.25V
P6-14, +TRIG
P6-5, -TRG
WHEN USING A FLOATING EXTERNAL REFERENCE, JUMPER 5 TO 8 & 1 TO 4 ON K3.
5. ALL RELAYS ARE SHOWN IN NORMALLY CLOSED (DE-ENERGIZED) POSITION.
4. ALL RELAY COIL CONTACTS ARE IDENTIFIED BY THE CONDITIONS FOR WHICH THE CONTACTS ARE GROUNDED.
3 ALL DIODES NLS 5003-002
2. ALL TRANSISTOR ARE TYPE 2N651
1. ALL RESISTORS ARE 1/2 WATT, 10 %
NOTES: UNLESS OTHERWISE SPECIFIED.
REVISIONS
SYM EFFECT DESCRIPTION DATE APPROVAL
10070-113
SHT. 2
UNLESS OTHERWISE SPECIFIED
DRAWN BY G. WALKER DATE 1-31-62
CHECKED BY
APPROVED BY R. HAMILTON DATE 2-2-62
MATERIAL
FINISH
TITLE
SCHEMATIC - REFERENCE SUPPLY
MODEL M25
NON-LINEAR SYSTEMS INC.
DEL MAR AIRPORT
DEL MAR, CALIFORNIA
10070-113
SCALE WT SHEET 2 OF



6. ALL SWITCH OR REMOTE CONTROL CONTACTS (P7-10, 16 THRU 22) ARE IDENTIFIED BY THE CONDITIONS FOR WHICH THE CONTACTS ARE GROUNDED OR CLOSED. FOR ALL OTHER CONDITIONS THE CONTACTS ARE NEGATIVE (−) OR OPEN.

5. ALL LOGIC CONTACTS (P8-11 THRU 22) ARE IDENTIFIED BY THE CONDITIONS FOR WHICH THE CONTACTS ARE NEGATIVE(−). FOR ALL OTHER CONDITIONS THE CONTACTS ARE POSITIVE(+).

10070-115 SHEET 2

4. ALL RELAY COIL CONTACTS (P7-1THRU 7 & P7-11 THRU 15) ARE IDENTIFIED BY THE CONDITION(S) FOR WHICH THE CONTACTS ARE GROUNDED. THUS P7-5 IS GROUNDED ONLY IF THE METER IS IN THE 1 MEG RANGE.

3. ALL RESISTORS ARE ½ WATT, 10%.

2. ALL DIODES ARE NLS 5003-002.

1. ALL TRANSISTORS ARE TYPE 2N651.

NOTES: UNLESS OTHERWISE SPECIFIED.

REVISIONS

SYM	EFFECT	DESCRIPTION	DATE	APPROVAL

NEXT ASSY	USED ON	NEXT ASSY	FINAL ASSY
APPLICATION		QTY REQD	

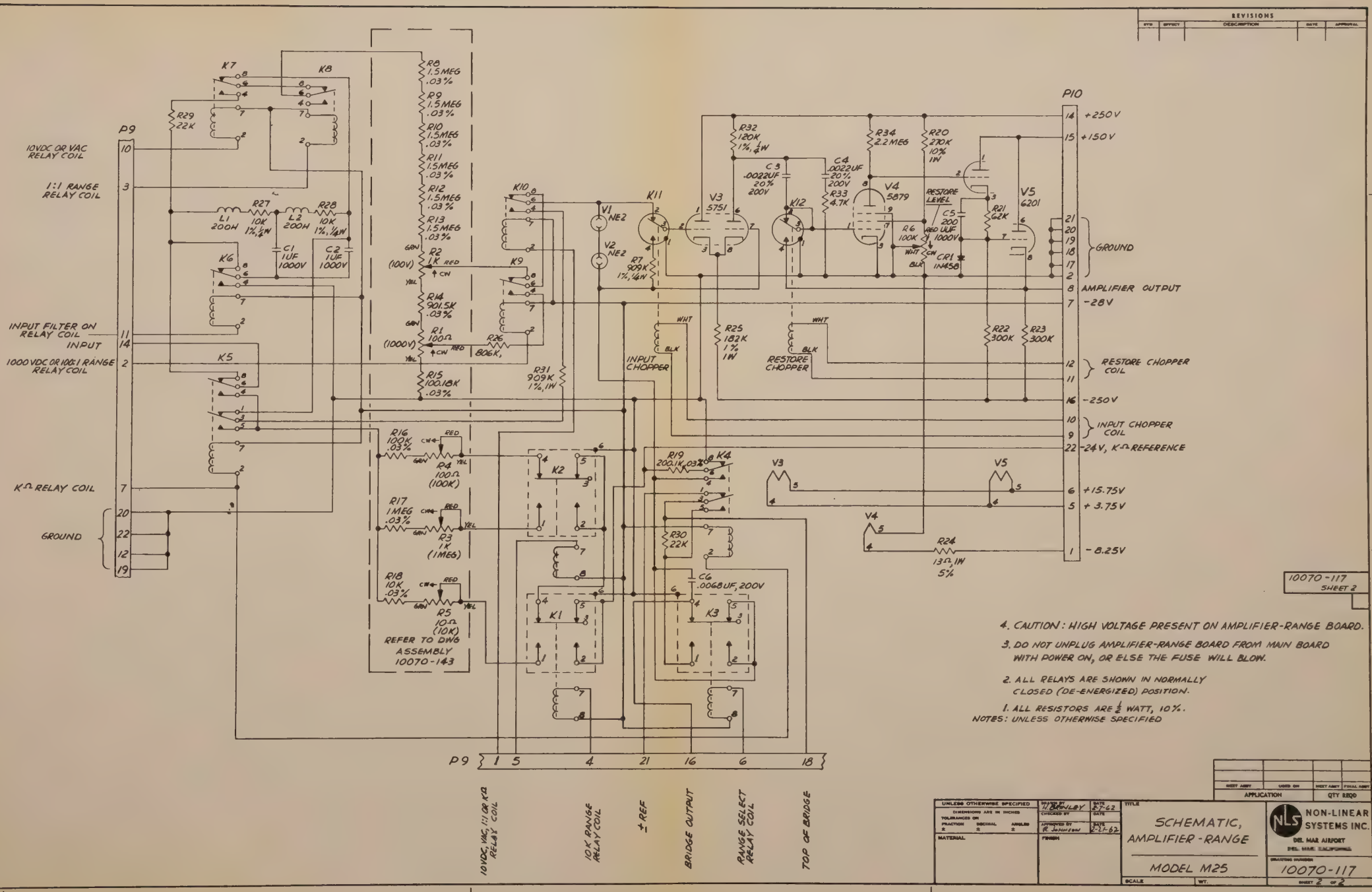
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTION ± DECIMAL ± ANGLES ±
MATERIAL

DRAWN BY H. BRINGLEY DATE 2-26-62
CHECKED BY DATE
APPROVED BY R. Hamaday DATE 2-27-62
FINISH

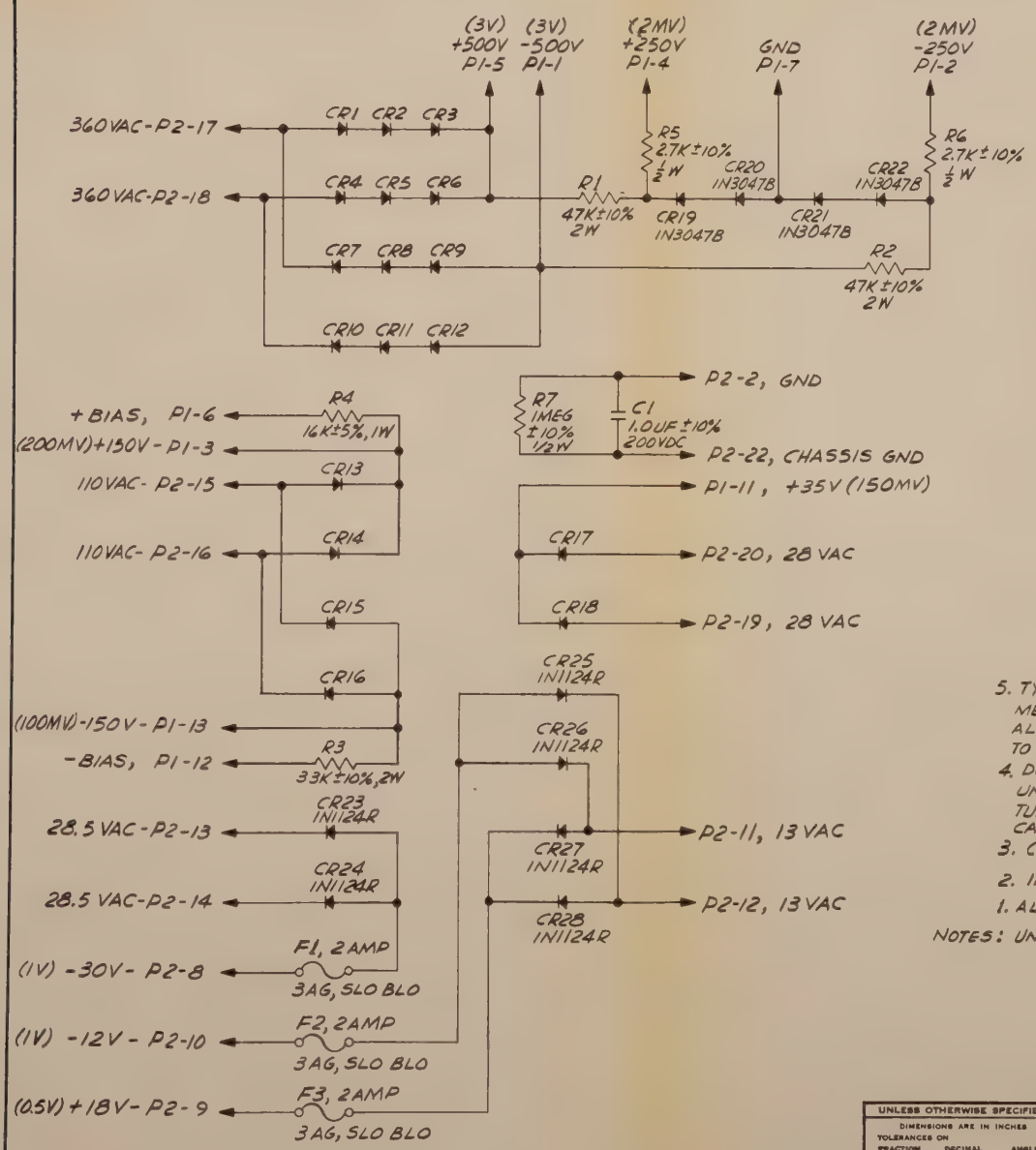
TITLE
SCHEMATIC, BUFFER
MODEL M25
SCALE WT.

NON-LINEAR SYSTEMS INC.
DEL MAR AIRPORT
DEL MAR, CALIFORNIA

DRAWING NUMBER
10070-115
SHEET 2 OF 2


REVISIONS
P9
P10
10VDC OR VAC RELAY COIL
1:1 RANGE RELAY COIL
INPUT FILTER ON RELAY COIL
INPUT
1000 VDC OR 100:1 RANGE RELAY COIL
KΩ RELAY COIL
GROUND
K1
K2
K3
K4
K5
K6
K7
K8
K9
K10
K11
K12
R1 100Ω (1000V)
R2 1K (100V)
R3 1K (1MEG)
R4 100Ω (100K)
R5 10Ω (10K)
R8 1.5MEG .03%
R9 1.5MEG .03%
R10 1.5MEG .03%
R11 1.5MEG .03%
R12 1.5MEG .03%
R13 1.5MEG .03%
R14 90.15K .03%
R15 100.18K .03%
R16 100K .03%
R17 1MEG .03%
R18 10K .03%
R19 200.1K .03%
R20 270K 10% 1W
R21 62K
R22 300K
R23 300K
R24 13Ω 1W 5%
R25 182K 1% 1W
R26 806K
R27 10K 1% 1/4W
R28 10K 1% 1/4W
R29 22K
R30 22K
R31 909K 1% 1W
R32 120K 1% 1/4W
R33 4.7K
R34 2.2MEG
R6 100K
R7 909K 1% 1/4W
L1 200H
L2 200H
C1 1UF 1000V
C2 1UF 1000V
C3 .0022UF 20% 200V
C4 .0022UF 20% 200V
C5 200 UUF 1000V
C6 .0068UF, 200V
CR1 1N458
V1 NE2
V2 NE2
V3 5751
V4 5879
V5 6201
RESTORE LEVEL
INPUT CHOPPER
RESTORE CHOPPER
REFER TO DWG ASSEMBLY 10070-143
+250V
+150V
GROUND
AMPLIFIER OUTPUT
-28V
RESTORE CHOPPER COIL
-250V
INPUT CHOPPER COIL
-24V, KΩ REFERENCE
+15.75V
+3.75V
-8.25V
10VDC, VAC, 1:1 OR KΩ RELAY COIL
10K RANGE RELAY COIL
± REF
BRIDGE OUTPUT
RANGE SELECT RELAY COIL
TOP OF BRIDGE
10070-117 SHEET 2
4. CAUTION: HIGH VOLTAGE PRESENT ON AMPLIFIER-RANGE BOARD.
3. DO NOT UNPLUG AMPLIFIER-RANGE BOARD FROM MAIN BOARD WITH POWER ON, OR ELSE THE FUSE WILL BLOW.
2. ALL RELAYS ARE SHOWN IN NORMALLY CLOSED (DE-ENERGIZED) POSITION.
1. ALL RESISTORS ARE 1/2 WATT, 10%.
NOTES: UNLESS OTHERWISE SPECIFIED
APPLICATION
QTY REQD
UNLESS OTHERWISE SPECIFIED
DRAWN BY W. BENTLEY
DATE 2-7-62
CHECKED BY
APPROVED BY R. Johnson
DATE 2-27-62
MATERIAL
FINISH
TITLE
SCHEMATIC, AMPLIFIER-RANGE
MODEL M25
NON-LINEAR SYSTEMS INC.
DEL MAR AIRPORT
DEL MAR, CALIFORNIA
10070-117
SCALE
WT.
SHEET 2 OF 2

REVISIONS				
SYM	EFFECT.	DESCRIPTION	DATE	APPROVAL



10070-119
SHEET 2

5. TYPICAL PEAK-TO-PEAK RIPPLE VOLTAGE MEASUREMENTS ARE SHOWN IN PARENTHESES. ALL VOLTAGES ARE MEASURED WITH RESPECT TO PIN 7 OF P1.
4. DO NOT UNPLUG RECTIFIER BOARD FROM MAIN BOARD UNTIL AT LEAST TWO MINUTES HAVE ELAPSED AFTER TURNING POWER OFF; THIS ALLOWS THE ELECTROLYTIC CAPACITORS TO DISCHARGE.
3. CAUTION: HIGH VOLTAGE PRESENT ON RECTIFIER BOARD.
2. IN3047B DIODE IS 130V ZENER.
1. ALL DIODES ARE IN2616.

NOTES: UNLESS OTHERWISE SPECIFIED

NEXT ASSY	USED ON	NEXT ASSY	FINAL ASSY
APPLICATION		QTY REQD	

UNLESS OTHERWISE SPECIFIED	DRAWN BY	DATE
DIMENSIONS ARE IN INCHES	H. BRINLEY	1-16-62
TOLERANCES ON FRACTION ± DECIMAL ± ANGLES ±	CHECKED BY	DATE
MATERIAL	APPROVED BY R JOHNSON	DATE 2-21-62
	FINISH	

TITLE: SCHEMATIC, RECTIFIER

MODEL M25

SCALE | WT.

NON-LINEAR SYSTEMS INC.
DEL MAR AIRPORT
DEL MAR, CALIFORNIA

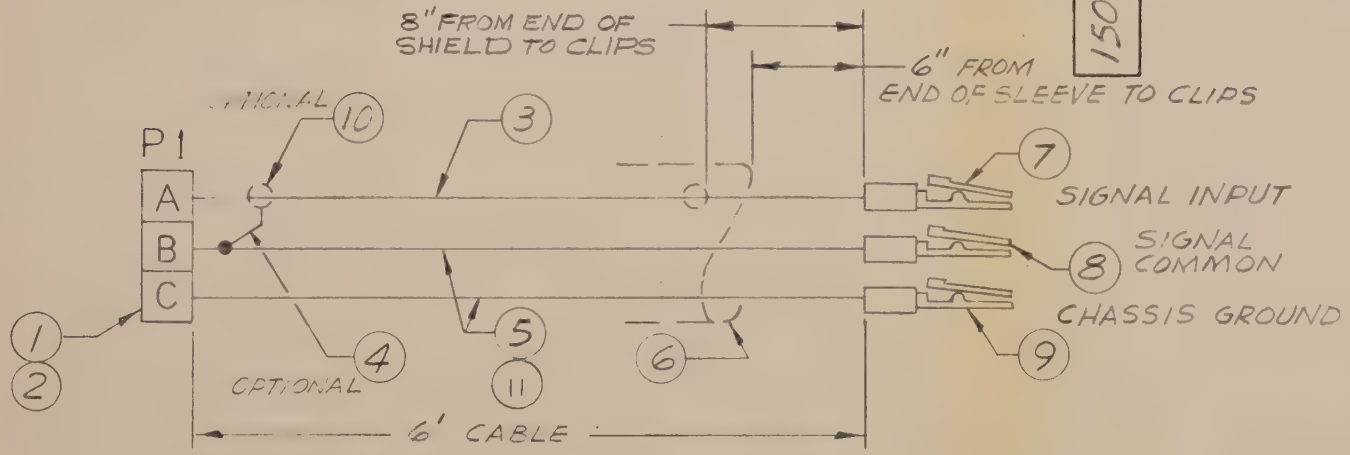
DRAWING NUMBER 10070-119

SHEET 2 OF 2

MANUFACTURERS LIST	
AMP INC.	HARRISBURG, PA.
AMPHENOL	CHICAGO, ILL.
ILLUMITRONIC ENGINEERING CO.	SUNNYVALE, CALIF.
H.H. SMITH INC.	BROOKLYN, N.Y.

15004-075 5

REVISIONS				
SYM	EFFECT	DESCRIPTION	DATE	APPROVAL
5	M25.1 & EM-24 10.812	REVISED & REDRAWN FROM "A" SIZE DWG.	10-13-61 HLH	
6	ALL	ADDED ITEM 11 & NOTE 5 ADDED MFG. LIST	4-24-62 RN	



ITEM	REQ'D	PART NUMBER	DESCRIPTION	MATERIAL OR MANUFACTURER	NEXT ASSY	USED ON	NEXT ASSY	FINAL ASSY
			LIST OF MATERIALS		APPLICATION		QTY REQD	
5	11	A/R	QQ-S-571B	SOLDER				
	10	1	323932	TERMASHIELD	AMP			
	9	1	300	CLIP (UNINSULATED)	H.H. SMITH			
	8	1	337	CLIP (BLACK)	H.H. SMITH			
	7	1	337	CLIP (RED)	H.H. SMITH			
	6	A/R	V105	SLEEVING, VINYL - 1/4" I.D., ILLUMITRONIC (BLK)				
	5	A/R	#20 AWG	WIRE, STRANDED - BLACK				
	4	A/R	#22 AWG	WIRE, STRANDED - BLACK (*24 TEFLON SLEEVING)				
	3	A/R	RG122/U	COAXIAL		10086	10086	1	1
	2	1	AN3057-6A	CLAMP		10070	10070	1	1
	1	1	573-0004-145-7426	CONNECTOR	AMPHENOL	10050	10050	1	1

5. SOLDER PER MIL-S-6872.

NOTES:

4. STAMP SYMBOL (P1) ON SLEEVING NEAR CONNECTOR.
3. STAMP PART No. (15004-075) ON SLEEVING.
2. CABLE TO BE TESTED FOR I.R. BETWEEN PINS B & C AND BETWEEN PINS B & C AND SHELLS OF BOTH CONNECTORS. I.R. TO BE 100 MEGOHMS MINIMUM AT 500V.
1. CABLE TO BE TESTED FOR I.R. BETWEEN PINS A & B, A & C ALSO BETWEEN PIN A AND SHELLS OF BOTH CONNECTORS. I.R. TO BE 200,000 MEGOHMS MINIMUM AT 500V.

H4-03626

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTION ±1/2" DECIMAL ± ~ ANGLES ± —

MATERIAL

FINISH

DRAWN BY H. ERINLEY DATE 10-13-61
CHECKED BY K. HANSON DATE 4-20-62
APPROVED BY DATE

TITLE
CABLE, INPUT

MODEL 20 SERIES

SCALE NONE WT. —

NON-LINEAR SYSTEMS INC.
DEL MAR AIRPORT
DEL MAR, CALIFORNIA

DRAWING NUMBER
15004-075

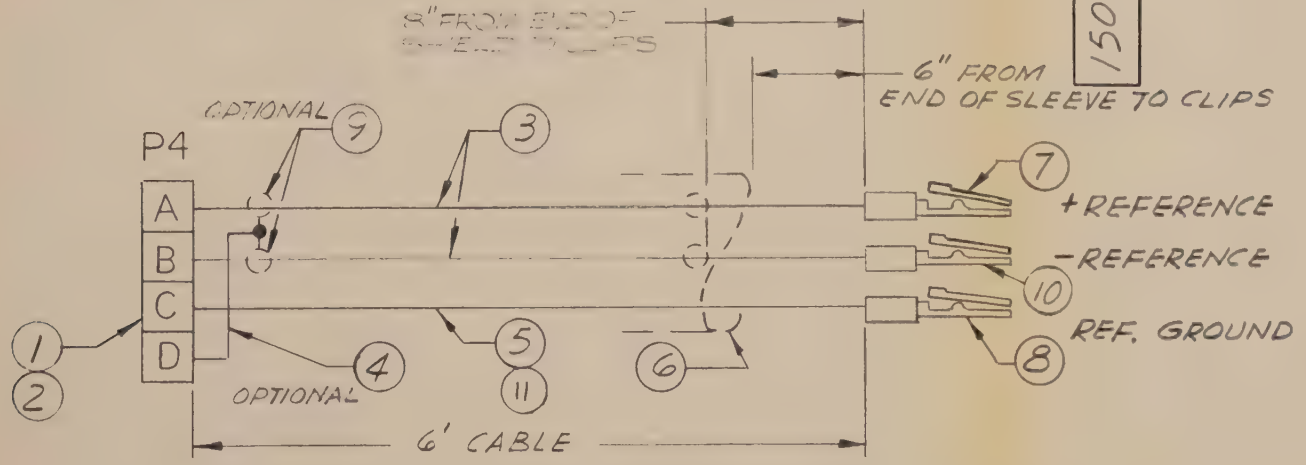
SHEET 1 OF 1

MANUFACTURERS LIST

AMP INC. HARRISBURG, PA.
CHICAGO, ILL.
ILLUMITRONIC ENGINEERING CO. SUNNYVALE, CALIF.
H.H. SMITH INC BROOKLYN, N.Y.

15004-077 4

REVISIONS				
SYM	EFFECT	DESCRIPTION	DATE	APPROVAL
4	M25.1 & M24 10.812	REVISED & REDRAWN FROM "A" SIZE DWG.	10-13-61 H.B.	
5	ALL	ADDED ITEM 11 & NOTE 4 ADDED MFG. LIST.	4-24-62 R.W.	



ITEM	REQ'D	PART NUMBER	DESCRIPTION	MATERIAL OR MANUFACTURER	NEXT ASSY	USED ON	NEXT ASSY	FINAL ASSY
10	1	337	CLIP (RED & BLK)	H.H. SMITH	10086	10086		
9	2	331232	TERMASHIELD	AMP	10070	10070	1	1
8	1	337	CLIP (BLACK)	H.H. SMITH	10050	10050	1	1
7	1	337	CLIP (RED)	H.H. SMITH				
6	A/R	V105	SLEEVING, VINYL-5/16" I.D.,	ILLUMITRONIC (BLK)				
5	A/R	#20 AWG	WIRE, STRANDED - BLACK					
4	A/R	#22 AWG	WIRE, STRANDED - BLACK (#24 PERMISSIBLE					
3	A/R	RG122/U	COAXIAL					
2	1	AN3057-6A	CLAMP					
1	1	973106A-14S-2S-426	CONNECTOR	AMPHENOL				

LIST OF MATERIALS | APPLICATION | QTY REQD

3. STAMP SYMBOL (P4) ON SLEEVING NEAR CONNECTOR.
2. STAMP PART NUMBER (15004-077) ON SLEEVING.
1. CABLE TO BE TESTED FOR I.R. BETWEEN ALL PINS AND BETWEEN ALL PINS AND SHELLS OF BOTH CONNECTORS. I.R. TO BE 100 MEGOHMS MINIMUM AT 500V.

NOTES:

H4-03626

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTION ± 1/2" DECIMAL ± ~ ANGLES ± ~

MATERIAL

FINISH

DRAWN BY H. BRINLEY DATE 10-13-61
CHECKED BY DATE
APPROVED BY R JOHNSON DATE 10-17-61

TITLE
CABLE, EXTERNAL REFERENCE

MODEL 20 SERIES

SCALE WT.

NON-LINEAR SYSTEMS INC.
DEL MAR AIRPORT
DEL MAR, CALIFORNIA

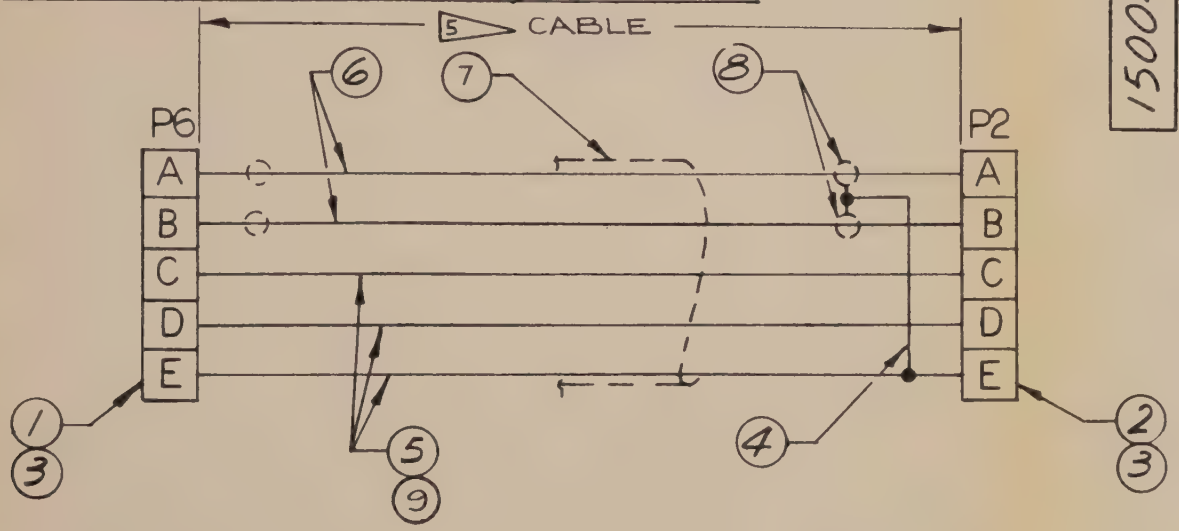
DRAWING NUMBER
15004-077

SHEET 1 OF 1

MANUFACTURERS LIST	
AMPHENOL	CHICAGO, ILL
AMP INC.	HARRISBURG, PA.
ILLUMITRONIC ENGINEERING CO.	SUNNYVALE, CALIF.
BELDEN MFG. CO.	CHICAGO, ILL

15004-078 (6)

REVISIONS				
SYM	EFFECT.	DESCRIPTION	DATE	APPROVAL
4	M25.1 & M24 10.812	REVISED & REDRAWN FROM "A" SIZE DWG.	10-18-61 HAB	10-19-61 RWJ
5	W.O. 104590C	ADDED NOTE 5 CREATING -1	1-9-62 ABW	R Grove 2-2-62
6	ALL	ADDED ITEM 9 & NOTE (6) ADDED MFG LIST	4-24-62 R.W.	4-26-62



ITEM	REQ'D	PART NUMBER	DESCRIPTION	MATERIAL OR MANUFACTURER	NEXT ASSY	USED ON	NEXT ASSY	FINAL ASSY
			LIST OF MATERIALS		APPLICATION		QTY REQD	
(6) 9	A/R	QQ-S-571B	SOLDER					
8	2	323932	TERMASHIELD	AMP				
7	A/R	V105	SLEEVING, VINYL 1/4" I.D., ILLUMITRONIC (BLK)					
6	A/R	RG174/U	WIRE, COAXIAL	BELDEN				
5	A/R	#20 AWG	WIRE, STRANDED - BLK					
4	A/R	#22 AWG	WIRE, STRANDED - BLK (#24 PERMISSIBLE)					
3	2	AN3057-6A	CLAMP; CABLE		10086	10086	1	1
2	1	97310GA-14S-5P-426	CONNECTOR	AMPHENOL	10070	10070	1	1
1	1	97310GA-14S-5S-426	CONNECTOR	AMPHENOL	10050	10050	1	1

(6) SOLDER PER MIL-S-6872.

(5) 15004-078-1 AS SHOWN, 6' CABLE; -078-2 IS 9'.

4. STAMP SYMBOLS (P2 & P6) ON SLEEVING NEAR ASSOCIATED CONNECTORS.
3. STAMP PART NUMBER ON SLEEVING.
2. CABLE TO BE TESTED FOR I.R. BETWEEN PINS C & D, C & E, D & E, ALSO BETWEEN PIN C, D & E AND SHELLS OF BOTH CONNECTORS. I.R. TO BE 100 MEGOHMS MIN AT 500V.
1. CABLE TO BE TESTED FOR I.R. BETWEEN PINS A & B, A & C, A & D, A & E, B & C, B & D, B & E; ALSO BETWEEN PINS A & SHELLS OF BOTH CONNECTORS, PIN B & SHELLS OF BOTH CONNECTORS. I.R. TO BE 100,000 MEGOHMS MIN AT 500V.

NOTES:

H4-03626

UNLESS OTHERWISE SPECIFIED	DRAWN BY H. BRINLEY	DATE 10-18-61
DIMENSIONS ARE IN INCHES	CHECKED BY CHEMMICK	DATE 10-19-61
TOLERANCES ON FRACTION ± 1/2" DECIMAL ± ANGLES ±	APPROVED BY K. JOHNSON	DATE 10-19-61
MATERIAL —	FINISH —	

TITLE

CABLE, BRIDGE REFERENCE

NON-LINEAR SYSTEMS INC.
DEL MAR AIRPORT
DEL MAR, CALIFORNIA

DRAWING NUMBER 15004-078

SCALE NONE WT. —— SHEET 1 OF 1

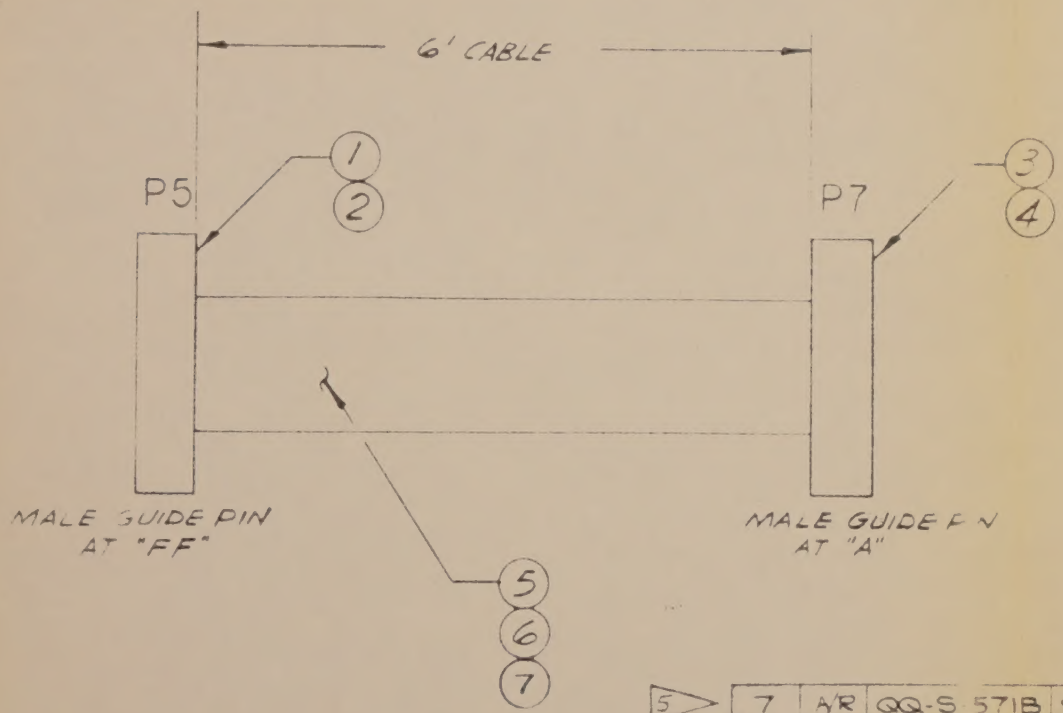
MANUFACTURERS LIST

CONSOLIDATED ELECTRO DYNAMIC CORP	PASADENA, CALIF.
ILLUMITRONIC ENGINEERING CO.	SUNNYVALE, CALIF.
MOHAWK ELECTRIC MFG. CO.	EAST ORANGE N.J.

15004-079 | 9

REVISIONS

SYM	EFFECT	DESCRIPTION	DATE	APPROVAL
4	M25.1 & M24 0.B12	REVISED & REDRAWN FROM "A" SIZE DWG.	10-17-61 H&B	10-17-61 R.W.T.
5	M.O. 1149300	ADDED NOTE 4 CREATING -1	1-4-62 AEM	[illegible]
6	ALL	ADDED ITEM 7 & NOTE 5	4-24-62 RW	[illegible]



ITEM	REQ'D	PART NUMBER	DESCRIPTION	MATERIAL OR MANUFACTURER	NEXT ASSY APPLICATION	USED ON APPLICATION	NEXT ASSY QTY REQD	FINAL ASSY QTY REQD
7	A/R	QQ-S 571B	SOLDER					
6	A/R	V105	SLEEVING, VINYL 5/8" I.D. ILLUMITRONIC (3/4" I.D. PERMISSIBLE)					
5	A/R	8750	CABLE, MOHAWK (22 AWG STRANDED, 50 PCS., ALTERNATE)					
4	50	97502	SOCKETS	C.E.C.				
3	1	2024-005	CONNECTOR	(NON-LINEAR SYS)	10086	10086	1	1
2	50	97503	PINS	C.E.C.	10070	10070	1	1
1	1	2024-004	CONNECTOR	(NON-LINEAR SYS)	10050	10050	1	1

LIST OF MATERIALS

5 SOLDER PER MIL-S-6872.

4. 15004-079 AS SHOWN IS 6' LONG; -079-1 IS 9' LONG.
3. STAMP SYMBOLS (P5 & P7) ON SLEEVING NEAR ASSOCIATED CONNECTOR.
2. STAMP PART NUMBER (15004-079) ON SLEEVING. (USE APPLICABLE DASH NO.)
1. CONTACTS TO BE WIRED A TO A, B TO B, C TO C, ... ETC.

NOTES:

H4-03626

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTION ± 1/2 DECIMAL ± ~ ANGLES ±

MATERIAL

DRAWN BY H. BRINLEY DATE 10-7-61
CHECKED BY [illegible] DATE 10-8-61
APPROVED BY P. JOHNSON DATE 10-9-61

FINISH

TITLE
CABLE
POWER & LOGIC
MODEL M24

SCALE NONE WT.

NON-LINEAR SYSTEMS INC.
DEL MAR AIRPORT
DEL MAR, CALIFORNIA

DRAWING NUMBER
15004-079

SHEET 1 OF 1

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systems, inc.

DEL MAR, CALIFORNIA

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